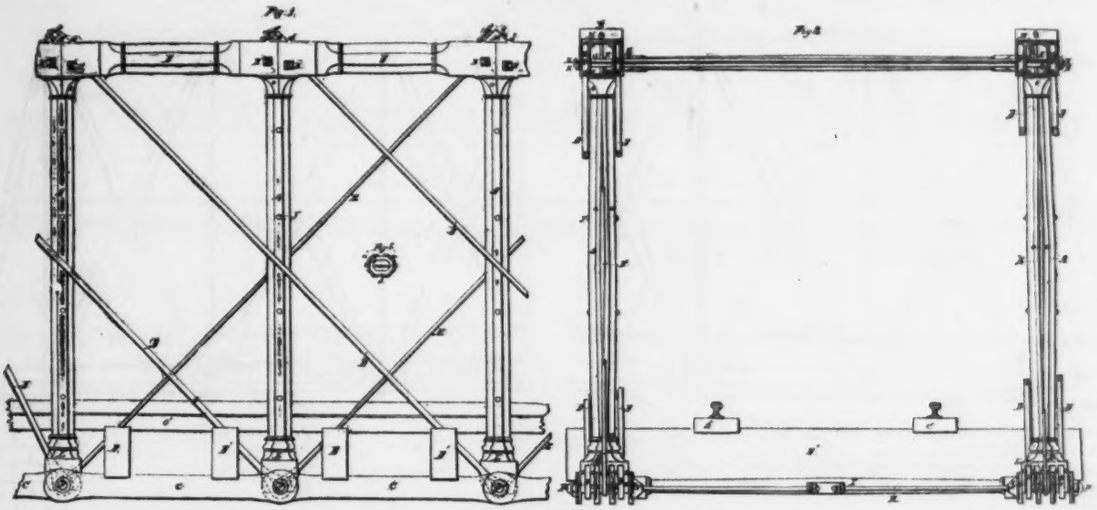
posed of a series of thin eye-bars of wrought-iron. They are fitted outside the bases *L*. The connecting pins *P* are supported by the suspension bars *D*, which as well as the counter diagonals are secured by said pins. The main portions *A* of the posts consist of two rolled plates of wrought-iron *a* of semi-polygonal form secured at intervals by rivets or shrunken bands. The plates *a a*, are close together at at the extremties but spring apart in their mid-length. The



LINVILLE'S TRUSS.

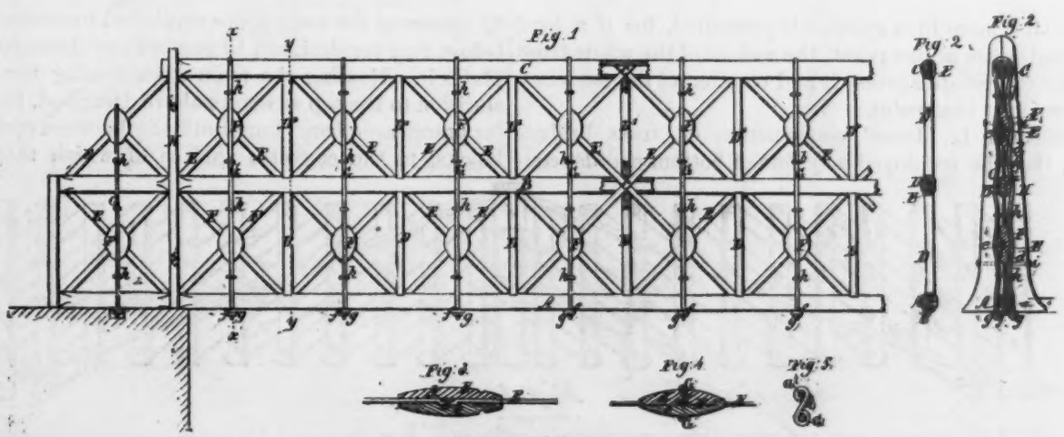
upper chords are of sectional cast-iron terminating in rectangular ends, *M* are angle blocks placed over the joints of the sections of the top chords, and between guide plates provided thereon, to form bearings for the nuts of the diagonals. Upper lateral struts of cast-iron are used, which rest in pockets or bearings in the sides of the top chords. The lower lateral diagonal tension braces *H* consist of short rods connected midway with a ring, and also connected with the bosses through which the pins *P* pass.

Linville's patent expired Jan. 14, 1879.

Jan. 21, 1862, Samuel D. Kendall, devised a truss girder of the following description: *A B C* are chords of cast-iron, each composed of two series of bars *a* and *b*, arranged side by side so as to break joint with each other. *D* are cast-iron posts placed between the lower and middle chord, and *D** are similar posts placed above the middle chords, *E* are two series of diagonal wrought-iron braces extending in opposite direction from the top chord *C* to the bottom chord *A* at the feet of the posts *D* and uniting with the top chord *C* and the heads of the posts *D**. These braces cross each other midway between the chords, and each is offset at every crossing (Fig. 3) to make each prevent the movements of the other in a longitudinal direction. The offsets form protuberances on the outer sides, which fit in recesses provided for them in the inner faces of the bars *a* and *b*. *F* are the binding blocks of cast-iron, applied at the crossings of the tension braces between the chords to secure the braces at those points. These blocks are composed of two pieces *d e* (Fig 2). They have recesses for the reception of the offsets of the braces. *G* are the vertical tension rods applied to the chords midway of the girder and opposite the binding blocks. They are made double in the form of long stirrups, which depend from the top chord and are secured below the bottom chord by plates *f* and nuts *g*.

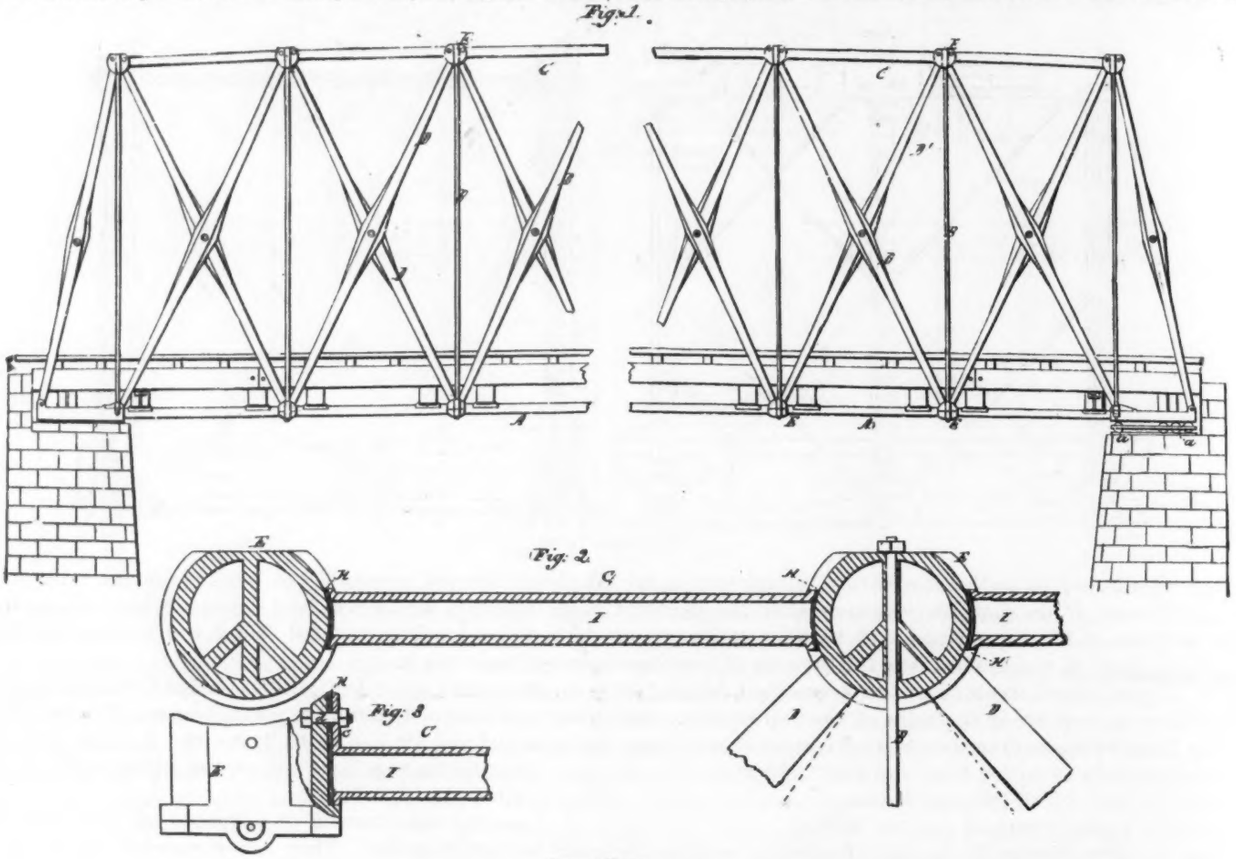
A. McGuffie's second invention consists in combining with a series of links of a chord, the posts, braces and joint blocks, so arranged and applied as to truss the links in the catenary line, and make a light and strong girder. His invention expired Feb. 4, 1879.

A A are the links formed of a double bar iron with the ends welded together. They are connected by the joint blocks *B*, which consist of large round pins of cast-iron inserted through the links. The chain thus formed is suspended from or kept in place by the chord or horizontal brace *C*, which rests upon the posts *D*. The connection between the chord and the chain is made by constructing the terminal links in the form of stirrups with screw threads on their ends and passing them through the chord, where they are secured by nuts *a*. The chord itself is a sectional tubular cast-iron, the sections being fitted together with tenons and shoulders as shown in the detail figure. The chord is supported at the posts *E* resting on the joint blocks



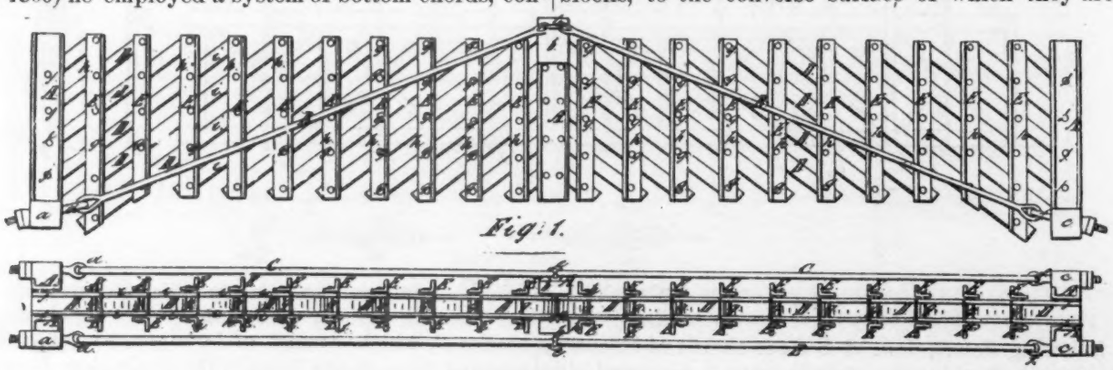
KENDALL'S TRUSS.

B, or by rods *c*, *f* are diagonal braces connected with the joint block and with the chord, the connection with the chord being at the tops of the posts belonging to the next joint blocks to those from which the braces start. By combining the chord posts and braces with the catenary series of links in the manner above described to truss the links in the true catenary line, the tendency of any one part of the girder to sink more than another is prevented, for if a load (it is stated) rests at one point, the weight of the whole truss is tending to operate against it and counteract the tendency to depression at that point.



JONES' TUSS.

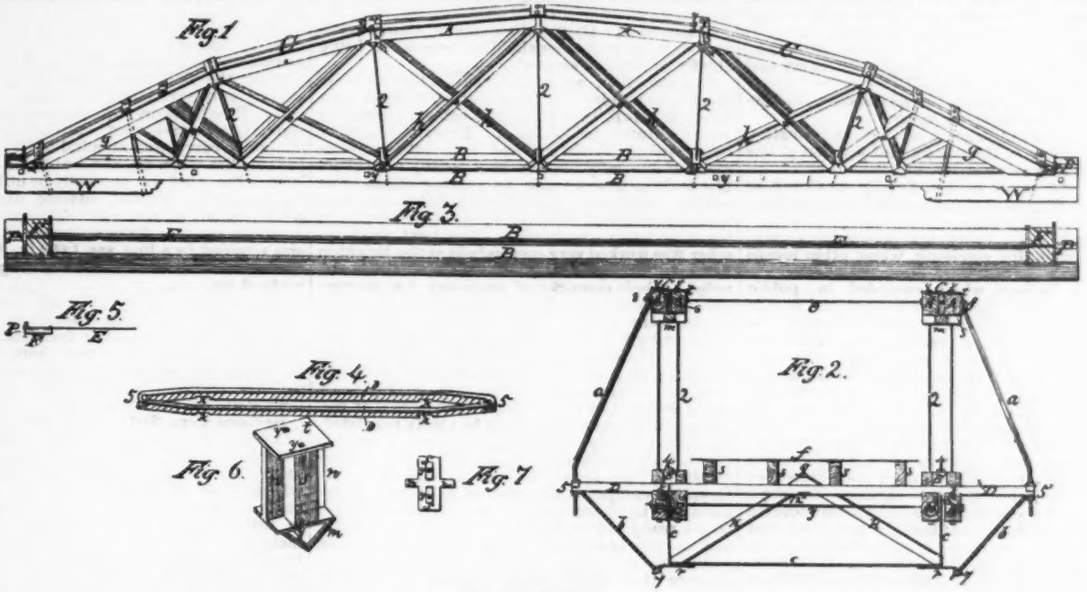
In Jonathan L. Jones' construction of truss bridges (Nov. 6, 1860) he employed a system of bottom chords, consisting of independent sections or plates of wrought iron, which are provided with a hooked shoulder, forming a joint at each end. The edges of the shoulders of the chords in contact with each other are rounded so that a perfect bearing will be insured, although the angle which the two chord sections form with each other may change the shoulder end of the plates thus hooked. These joints are locked into corresponding recesses in the blocks which encompass the joints of the chords. In this construction the use of bolts passing through the chords and tending to weaken them is avoided. These encompassing blocks are made flaring from the center outward, both ways, in order that the chord-plates may change the angle they form with each other, and thus accommodate themselves to the varying camber of the bridge without being strained in the blocks. The wrought iron tension top-plates, or stringers, are locked into each other by means of the same splice employed to connect the chords below, and are designed to prevent any derangement of the plates in adjusting the truss when raising the bridge. In addition to the top stringers above described, cast-iron tubular braces are placed longitudinally between each two of the blocks, to the converse surface of which they are fitted. These braces are designed to act as plates to resist the compressive action of the upper portion of the bridge.



EIKENBERRY'S TRUSS.

An additional improvement was granted Lewis Eikenberry Jan 22, 1861, for a truss. His former invention of 1859 was styled a compensating bridge, in that it compensated to the expansion and contraction of the metal portions. The present bridge is similar as regards construction, but differs as regards the details of construction. Eikenberry states that before the date of his invention a bridge of cast iron had

not yet been constructed which combined strength and lightness. In fact, he says, the first quality is lacking in those bridges of cast iron, which are made exceedingly heavy, because the cast metal will not bear the strain caused by sudden expansion and contraction, and hence the want of confidence on the part of the public in cast-iron trusses. Eikenberry's invention is designed to obviate the difficulties experienced with cast-iron bridges, and to enable an engineer to erect iron bridges which will be light, stiff and durable at a comparatively low cost. To this end his invention consists (1) in a side frame or truss for a bridge, having its diagonal braces, or diagonals and uprights, constructed of angle iron. and (2) in the combination of double angle iron or U-shaped diagonal braces, with single angle iron uprights or diagonals.



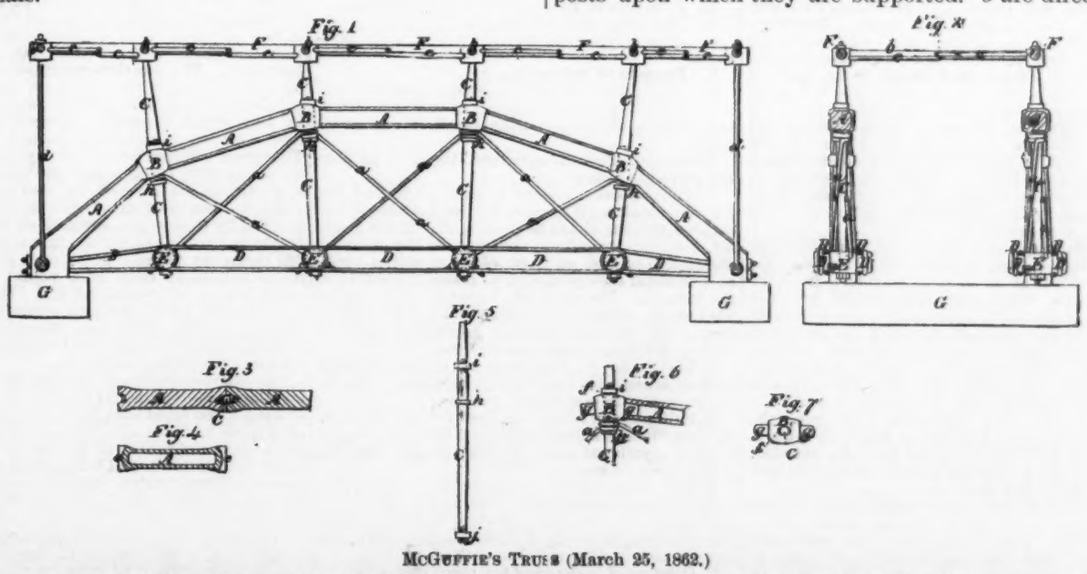
JUNKINS' TRUSS.

A represents the main uprights U-shaped in section. They terminate, as shown at *a*, *b*, *c*, in solid ends, so as to provide substantial anchorage for the eyes of the screw-bolts *d*, *e*, *f* of the cable *B C*. *D* are the double angle iron diagonal braces. The parts *D* and *E* are pivoted together at *g*. These united parts form a very light but stiff truss, the lateral angles of the single angle iron braces or uprights serving to prevent warping, twisting and collapsing of the frames.

June 4, 1861, John H. Junkins devised a bridge whereby he is enabled to remove and repair any portion of the braces, suspension rods, sections of arches, etc., without affecting the remaining portions of the structure.

In 1862 (March 25) A. McGuffie devised another bridge upon the same principle as the one preceding. A novel arrangement of the arch sections, posts, links, and braces is secured by which a light, strong, and (it is said) easily-constructed bridge is obtained.

A represents a number of hollow arch sections, having their ends beveled so that, by abutting against each other or the interposed angular heads *B*, they will form arches. *C* are the posts, intersecting the arch between the sections and serving to suspend the roadway therefrom. *D* are wrought iron links connecting the bottom of the posts with the ends of the arch. *a* are oblique tension braces from the posts to the joint blocks *E*. The top chords *F* are made in sections and arranged in horizontal lines at the top of the posts upon which they are supported. *b* are direct lateral



MCGUFFIE'S TRUSS (March 25, 1862.)

braces arranged between the chords *F* and serving to keep the chords and posts at a proper distance apart.

When the sections *A* abut directly against each other, as shown in Fig. 3, with the interposition of the angular blocks *B*, grooves *e* are provided in their ends for the reception of the posts, but when the angular heads *B* are used the sections receive the tenons *g* on the heads, as in Fig. 6, and holes *f* are provided for the posts to pass through, and which holes are elongated at top and bottom to allow of the proper adjustment of the arch sections.

[TO BE CONTINUED.]

MILITARY BALLOONING.

A LECTURE on this subject was recently delivered at the Royal United Service Institution by Lieutenant B. Baden Powell, Scots Guards. In dealing with the subject, the lecturer first entered into the history of balloons as used in actual warfare; of experiments conducted on the subject; of the causes of success and failure in ascents; the relative advantages and disadvantages of captive and free balloons; the means and methods of inflation; and the question of navigating balloons.

Balloons, the lecturer points out, may be used in warfare for the following purposes:

They may be carried with advanced parties and sent up to ascertain the position of the enemy and the nature of the country ahead.

They may be employed to reconnoitre the enemy's position previous to a battle.

They may be utilized in noting the formation and movements of the troops, and position of the reserves during an engagement.

They could often be beneficially employed as sentries on outpost duty, and would be exceedingly useful during sieges.

They may often prove invaluable for escape, communication, for signaling, when other means fail.

The first balloon which ascended in public was launched by Montgolfier in 1783, and in 1793 the French instituted some experiments on the subject. The following year a regular balloon corps was formed composed as follows: 1 captain, 1 sergeant-major, 1 sergeant, 2 corporals, and 20 men, half of whom at least were experienced in the trades necessary for balloon service, viz., masonry, carpentry, painting, chemistry, etc. These men were termed "aerostiers," and were armed with a sword and two pistols each, being entirely subject to military discipline during the time they were in the field. Several balloons for these aërostiers were made of specially manufactured Lyons silk, and were so efficiently varnished that they were said to have remained inflated for three or four months. The first was 27 ft. in diameter and could support 500 lbs., 10lbs. to 20lbs. of ballast being taken in the car. The balloons were held captive by two cords fixed to the equator by network, and which allowed them to rise about 1,500 ft. For transporting the balloon twenty cords were fixed to the equator by triangular pieces of netting to equalize the strain, and one man was told off to each cord to tow it along. At night it was snugly secured under a large piece of sailcloth. There being a difficulty at the time in procuring sulphuric acid, the hydrogen was produced in passing steam over red-hot iron, and a furnace was built which after many trials was capable of producing sufficient gas to fill the balloon in four hours. Communication was kept up by flags, and by notes thrown overboard, tied to sand-bags or loaded arrows. These balloons all did good serviee at the battle of Fleurus; two ascents were made each of four or five hours, notwithstanding a strong wind. All the movements of the enemy were observed and reported, and the success of the French at this battle is said to have been greatly due to the aid of this balloon. It was found to be preferable to attach the cable to horses or men rather than to fixed objects, as the strain on the balloon was thus considerably lessened.

During the siege at Mainz in 1799, Coutelle made some ascents during a very strong wind. He writes: "I was at more than 1,000 feet from the ground, when three successive squalls knocked me to the ground with such rapidity and force that many of the bars that strengthened the bottom of the car were broken. On each occasion the balloon rose with such force and rapidity that thirty-two men at each rope were dragged some distance." He nevertheless managed to count the enemy's force. The Austrians even went the length of sending out a flag of truce to request Coutelle to descend from his perilous position. This shows that a balloon reconnoissance is possible even in a high wind.

In 1812 the Russians constructed a huge balloon at Moscow to carry fifty persons, which was to hover over the French army and rain shells and projectiles. The balloon, however, refused to rise from the ground. In the Civil War in America several balloons were used. On October 4, 1861, an aeronaut named La Mountain ascended in a balloon from McClellan's camp on the Potomac. He cut the retaining rope and ascended to a height of 1½ miles, when he drifted over the enemy's lines. After observing all their positions and movements, he rose into another current of air and descended safely into his own lines. Later on the Federals instituted a regular balloon corps, of which Colonel Beaumont, R. E., has written an interesting account in the Royal Engineer professional papers.

The first military balloon experiments in England took place in July, 1862, at Aldershot.

In the Franco-German war the Germans tried balloons, but the system was not satisfactory, and little good was done. During the siege of Paris balloons were used in a more extensive manner. Two were employed as observatories to watch the enemy. Larger balloons were then constructed. They were made of strong cambric, oiled, and of about 70,000 cubic ft. capacity, and cost about £160 each. They were filled with coal gas, and could carry a load of 2,000 lbs., including 600 lbs. ballast and about 1,000 lbs. dispatches. The first of these, the "Armand-Barbe," bore Gambetta beyond the reach of the Germans. During four months sixty-six balloons left Paris, of which fifty-four were specially constructed for the Administration of Posts and Telegraphs. About one hundred and sixty persons were carried over the Prussian lines. Of the aëronauts in charge only twelve were professionals, the remainder being chiefly sailors and acrobats.

In June, 1871, an English committee was appointed to inquire into the use of balloons for warfare. In April, 1879, an official balloon committee was instituted in England. Experiments were conducted at Woolwich, and four balloons were made of specially woven fine calico, varnished. The hydrogen was made by passing steam over red-hot turnings. One of the balloons was tried free at a review at Woolwich, but failed, owing to the wind being unfavorable. The next year another was worked very successfully at the Brighton Review. In September, 1880, the War Office detailed a whole company of engineers for instruction in ballooning at Aldershot, and many experiments were made. Meanwhile, the French Government have established a military aeronautical school. Their balloons are spherical, 10 metres in diameter, of best silk, varnished with a special varnish which keeps them very gas-tight. A liquid which does not readily freeze is used as ballast, so that the discharge can be nicely regulated. English military ballooning received a sudden check with the accident to the War Office balloon "Saladin," in December, 1881, but when the Egyptian campaign commenced a balloon equipment was to be sent out. However, this could not be got ready before the decisive battle was fought, and so we have lost the opportunity of gaining experience as to their use, not to mention the assistance they might have rendered in the campaign.

From the experiences quoted above the lecturer drew the conclusion that whenever a regular organized and specially prepared balloon equipment has been employed it has worked satisfactorily, and he suggested that more than one balloon should be employed for observation. He quoted a paper by Major Grover, who raises the following objections to the employment of balloons in war:

1. The chance of their being wrecked by projectiles.
2. Difficulty of transporting the apparatus.
3. Difficulty of providing gas.
4. Difficulty of obtaining good trained aëronauts.
5. Dangers of ballooning.
6. Obstruction of view by smoke or otherwise.
7. Difficulty of management in rough weather, and motion of balloon unfavorable for observation.

Lieutenant Powell answered these objections somewhat as follows:

1. The balloon would as a rule be behind the first line, making it hard to hit, and probably not much attention would be paid to it. If not badly hit, it could be repaired, and even in the case of a shell bursting just in front of it, it would probably descend slowly enough to insure the safety of the inmates. He gave an instance of a balloon 800 feet up, which was fired at by an 8 inch howitzer. The shell burst just in front, and the balloon took fifteen minutes to descend.

2. The transport has been so simplified that balloon accessories and filling apparatus can be easily carried in one or two wagons.

3. Balloons can remain inflated for a long time. The old Fleurus balloon remained full for a month, making continual ascents, and undergoing the rough usage of war.

4. It is not absolutely necessary for a man to be a trained aeronaut from his birth; any man can learn the work. Instance the Paris balloons. Good draughtsmen should be trained to the work, as they would then be useful in both capacities.

5. Dangers of ballooning are much exaggerated. The deaths that have occurred are not more than 1 in 1,000 ascents, and good aeronauts have made over 1,000 ascents without accident. Accidents are principally due to passengers being thrown out or jumping out of the car on concussion with the ground when descending during a strong wind.

6. The lecturer quoted from his experience that the smoke from guns does not obscure the view, except perhaps on a very calm day.

7. Balloons can be employed in very rough weather, as is shown by the French war balloons of 1793 described above. The lecturer was himself up in a captive balloon at the last volunteer review in a very stormy southwest breeze, and was enabled to use his field-glasses, and obtain a very good view of the field of operations.

Captive balloons are, no doubt, the most suitable for war purposes. They are independent of the direction of the wind, can be hauled down without loss of gas, and communication can be easily kept up. A strong wind is the great enemy to captive balloons. A long cylindrical shape has been suggested. The French tried one in 1793, but apparently it was not successful. It has the following advantages over the usual shape:

It may be filled and kept sheltered from wind and from the enemy's sight. It is easier to transport in a wind or through forests. It can be towed better, and would be steadier for observation.

Small balloons retained by a string have been used for taking plans of the country beneath, by instantaneous photography, an electric wire connecting the apparatus with the ground. Many experiments have lately been made in this direction. Free balloons require much less ascensional force than captive ones, as they have no weight of rope to carry, and no wind to withstand. They are steadier when up, and less liable to be hit by shot. The wind can generally be utilized by working properly. Finally, adverse currents can be made useful, as was done in the American War. A small satellite balloon, weighted as required, and retained by a line, say 1,000 ft. long, is useful for ascertaining the direction of neighboring currents of air.

The lecturer's father, the late Professor Baden Powell, suggested small balloons for scientific use with Sir John Franklin's fatal polar expedition. There was no time to prepare them then, but later on, when Sir James Ross was sent out on the search expedition, balloons were utilized. The following are the particulars:

Balloons were first used in the Arctic Regions in 1850, in the Arctic searching expedition under Captain Horatio Austin, for the purpose of distributing papers containing information of the whereabouts of our ships and the depots of provisions. These printed colored papers were tied in little bundles to a slow match which was attached to the balloon, and as the slow match burnt the papers were set on fire. Forty balloons were taken; silk, 8 ft. to 5 ft. in diameter, and they cost £164. The hydrogen gas used was generated by sulphuric acid and granulated zinc.

The ascensional power of a balloon is obtained by rendering it lighter than the displaced volume of air. This is accomplished either by filling it with a lighter gas or heating the air inside so as to make it expand. Hydrogen, being the lightest gas known, is the best for inflating balloons. The objection to it is that it is more expensive, and being more subtle, is harder to retain than coal gas. Its rate of diffusion is about 2½ times greater than coal gas; 60 lbs. to 70 lbs. may be taken as the lifting power of 1,000 cubic feet of hydrogen.

Hydrogen is usually produced by the action of dilute sulphuric acid on iron or zinc; 250 lbs. of iron are required to produce 1,000 cubic feet of hydrogen. The gas thus produced costs about £1 5s. per 1,000 cubic feet. A good portable apparatus will fill a baloon of 6,000 cubic feet capacity in four hours. Another method of producing hydrogen is by the action of steam on red-hot iron. This gives a lighter gas. The oxygen of the steam combines with the iron and the hydrogen is liberated; this is the method adopted by our civil engineers. The most simple and rapid plan, though practically useless on account of the expense, is by placing a piece of sodium in water, when about 700 times its volume is at once given off. The metal at present costs 5s. a pound, so that 1,000 cubic feet of gas would cost £22. Hydrogen may also be obtained by passing a current of electricity through water. Coal gas, when it can be employed, is more convenient; its lifting power is 35 lbs. per 1,000 cubic feet of gas.

The original system of Montgolfier of inflating a balloon by rarefying the air within it by heat is so simple and rapid that it at once suggests itself as suitable for war balloons. But on the other hand its lifting power (25 lbs. to 30 lbs. per 1,000 cubic feet) is small, and it is so difficult to retain such a balloon captive, while the danger of catching fire is so great that it has not been found serviceable in practice. A balloon is generally made of cotton or silk, covered with a varnish chiefly composed of boiled linseed oil, and often containing india-rubber. Balloons have been made of macintosh, cold-beater's skin, and even copper. The weight of the material of an ordinary balloon is about .02 lbs. to .05 lbs. per square foot. The cordage has been sometimes made of silk in order to be light and strong.

There are two general principles on which it has been attempted to navigate balloons; 1st, by utilizing the different currents of air; 2d, by mechanical propulsion. The first requires perpetual rise and fall of the balloon, which means an expenditure of gas and ballast, the life and blood of the balloon. The lecturer suggested the use of a powerful safety lamp, in order to expand the gas when required. In a balloon of 25,000 cubic feet, raising the temperature 1 deg. would be equivalent to discharging 4 lbs. of ballast.

Several experiments have been carried out in the direction of propulsion for balloons, and some

very partial success has been obtained, but none giving much encouragement. The lecturer concluded his interesting paper by quoting Carlyle's words, which he feared for the present must remain true. "Beautiful invention, mounting heavenward so beautifully, so unguidably, emblem of much and our age of hope itself." In the discussion which followed Major Templer said he did not consider the system proposed by the lecturer of raising or lowering the balloon by varying the temperature of the gas practicable. He stated that his experience had taught him that the gas used for inflation should be kept at as constant a temperature as possible, and that the alterations in temperature proposed would have the effect of wasting the gas more than the discharging of gas and ballast. As far as the conveyance of the balloon accessories were concerned, a two-horse wagon should be able to take the gas generator. He stated the weight of the present French equipment to be 2 tons 6 cwt., and the capacity of the balloons to be 1,700 cubic feet. Captain Lee considered that failures in ballooning were due, to a great extent, to small details being neglected, and insisted upon the necessity of careful and accurate training. Balloons in warfare should never be expected to move about very much, and protested against generals in command expecting them to be as handy as light cavalry. He explained that the committee at Woolwich were endeavoring to lighten the balloons by making them of bullocks' intestines; the difficulty experienced in the use of this material being to get it to stand the folding and packing necessary for transportation. He considered that captive balloons should be made as small as possible in order to lessen their resistance. Colonel Beaumont considered that the lecturer was inclined to pass over the difficulties. The reason that balloons have not been more used, was the difficulty of providing them with a motive power. He pointed out that this difficulty lay in the fact of there being comparatively no fulcrum for the propelling lever to act against, and stated that an effective engine for balloon propelling purposes would require to give ten times the power of any engine yet invented, weight for weight. He considered that balloons would be very useful in sieges for taking photographs, but that the difficulty in taking a series of photographs is not so much the adjustment of the lens, as that of keeping the balloon at the same height. He thought that a balloon was a very bad means of conveyance on account of its limited carrying capacity, and that it would be more useful to convey intelligence into a besieged town, than to carry people out of it. In order to do this, it would be necessary that it should have some propelling power. The lecturer in answering the objections raised, said that one horse-power could be obtained for a weight of 50lbs., and that there was very little chance of two balloons approaching one another, as if captive they would necessarily be moored at some distance apart, while if free, the chances were almost as great that they could not close one another.

The Chairman, in summing up, said that one of the great difficulties in ballooning was that the balloonists became like the balloons themselves, flighty, and were apt to overlook practical difficulties. He did not consider that balloons were applicable to the ordinary conditions of warfare, but would be very useful in sieges. He considered that the lecture had understated the weight necessary to be transported. He himself put it down at 5 tons. He said that balloons would have been of no use in Egypt, as it would have been impossible to have transported the weight over the desert. When a portable propelling machine can be arranged then balloons may have a future.

With reference to the uses to which the lecturer considered that balloons might be put we think that in the present stage of knowledge, and considering the unwieldiness of a balloon and its belongings, it would certainly be rash (to say the least of it) to utilize it for outpost work, or in the fore-front of battle. Of the historical view little need be said, except that great thanks are due to the lecturer for laying it all so concisely before the public. There appears to be no doubt that at present we must be content with captive balloons, and of the advantages of these for observation there can scarcely be much difference of opinion. From the data given by the lecturer, coal gas would appear to be on the whole the most suitable for inflation. With reference to Sir Charles Nugent's opinion that balloons would have been useless in Egypt, we have the opinions of officers who were out there, that they would, on the contrary, have been of great assistance. It must be remembered that very shortly after our landing at Ismailia the railway was in working order, and though the difficulty in obtaining engines prevented all the stores being transported by rail, yet there is no doubt that room could have been easily found for one or more balloons, and the advantage of having an uninterrupted view of the enemy must be very apparent. A balloon sent up from Alexandria would have overlooked all the enemy's lines at Hafir Dowar.—*Engineering.*

NEW SUEZ CANAL AFFAIRS.

[Paris Dispatch to the London Times.]

At the annual meeting of the Suez Canal Company the attendance, for obvious reasons, was unusually large, and the conversation carried on before the proceedings commenced was anything but complimentary to England, while it showed resignation to the idea of doubling the canal at an early date as a concession or checkmate to English agitation. M. de Lesseps was loudly cheered on taking the chair. The three English directors were on the platform; also Mr. Plunkett, as representative of the English government, and M. Emile Ollivier, as counsel to the Egyptian government.

The year's accounts were then submitted. The total revenue amounts to 63,409,593f. This is apportioned as follows: First to expenditure. The total expenditure amounts to 18,267,786f., of which 11,632,000f. falls to interest of bonds, 2,433,000f. to the traffic service, and 2,142,000f. to repairs. Secondly, to interest of capital, 9,835,000f. Thirdly, to interest of consolidated coupons, 1,700,000f., and two minor items—in all 30,341,000f., which leaves a surplus of 33,341,000. From this must still be deducted the 5 per cent. for the reserve fund, viz., 1,667,000f. The net profit is, therefore, 31,674,313f. Of this sum 71 per cent, is paid to the shareholders, 22,488,000f.; 15 per cent. to the Egyptian government, 4,751,000f.; 10 per cent. to the founders, 3,167,000f.; 2 per cent. to the Directors, 633,000f., and 2 per cent. to the employés, 633,000f. These figures come out as dividends thus: On shares, 56f.; founders' parts, 31f.; delegations, 82f. This gives a net payment on each five-hundred-franc share of 81f., or upward of 16 per cent., against 68f. paid last year. The dividends paid since 1874 have been as follows: 1874, 25f.; 1875, 26f. 88c.; 1876, 28f. 55c.; 1877, 32f. 99c.; 1878, 31f. 44c.; 1879, 29f. 87c.; 1880, 46f. 89c.; 1881, 68f.; 1882, 81f. The present dividend is thus considerably higher than any former one.

M. de Lesseps then read the report, a lengthy document, which, after describing the traffic and operations of the year, discussed the "general situation." Here it was not always easy to tell what was text and what was commentary, for M. de Lesseps, with his usual fluency, would now and again supplement the report by remarks for which he was himself, of course, exclusively responsible. The insinuation that the British government contemplated any violation of the company's rights was repelled as a maneuvre of designing persons, and an article from the *Times* of December last was quoted in proof of the binding character of the arrangements, as to rates and otherwise, between England and the company. The loyal co-operation of the English delegates on the board was also recognized, and M. de Lesseps peremptorily affirmed that England contemplated no infringement of the company's position. The agitation in England was condemned as barren, and in proof that it was not the cause of the company's design of doubling the canal, the report quoted the minutes of the board meeting in January, when such an eventuality was distinctly recognized, although, as a concession to the English government, the board undertook not to commit itself to the enterprise without England's approval.

Lord Granville's dispatch to Washington and his speech in the House of Lords last summer on the Panama Canal question were likewise cited to the effect that the Panama Canal must be equally open to all nations, and it was urged that England could not consistently take up one ground at Panama and another at Suez. The testimony of Mr. Baxter to the fairness of the company's management was also quoted. Some English newspapers, it was observed, while eulogizing the President, had been proposing to oust the company from its rights, while others had been insulting him and denouncing him as a despot and dictator. The President, however, had never acted, and would never act, without having deliberated with the directors, nor without the approval of the shareholders. Some of these assailants were prominent 20 years ago in decrying the canal as impracticable and in professing pity for the people who had invested their small savings in it. Yet they would fain now deprive these people of the fruits of their enterprise.

As to reduced rates, the report recognized the interests of shipping, but vindicated the right of the shareholders to be enriched in return for the sacrifices they had made, and hinted that when the dividend had reached 20 per cent. the time would have arrived for concessions on this head. Unless the shareholders were properly remunerated the people would be deterred, it was suggested, from entering into undertakings of public utility. They had the same right as manufacturers and merchants to a good interest on their capital.

As regarded the question of a second canal, the directors have been giving consideration to the necessity of constructing a second canal to meet the requirements of an ever-increasing traffic. The question was still under examination, and the directors had not yet discussed the means of carrying it out. Suggestions from all sides would, however, be duly considered, and with the loyal co-operation of the English government a satisfactory solution might be expected. The report concluded by insisting that the company was in a better situation than any outsider to make the second canal, and that it alone had the right to do so.

THE MANUFACTURE OF SEWER PIPE.

One of the principal industries of the great and prosperous State of Ohio is the manufacture of sewer pipe. A glance at our advertising columns will show where the largest and best known of all the manufactories of this ware are located. Prominent among them is the section of country about 13 miles in length lying between the villages of Wellsville and Toronto, on the banks of the Ohio River, in which district there are nine manufactories of sewer pipe. Of these the Calumet Fire Clay Company's works, at Calumet, O., about 10 miles north of the flourishing city of Steubenville, take first rank. The company owns 23¼ acres of the best clay land, with overlaying strata of bituminous coal interspersed throughout its entire area.

This mixture of coal and clay involves regular mining processes for taking out the material. The clay is now taken from a depth of between 80 and 140 ft., and the supply, of a fine, uniform quality, is considered as practically inexhaustible. The mining of both the coal and clay is done by drifting in four directions, pillars 50 ft. square being left as supports. The clay is so hard as to require blasting. Both it and the coal are brought down to the works on tramways.

The clay, after being "weathered" or slacked by exposure, is reduced by machinery to a properly pulverized condition. It is then screened and tempered in pans, when it is in proper condition to make up into the various wares manufactured.

By means of elevators it is then carried to the top floor of the building: Here is a machine consisting of a large steam-cylinder connecting with a mud-cylinder into which the clay is shoveled by a workman. On the bottom of the mud-cylinder there is a die fixed of the shape of the pipe or whatever article is wanted. The machine is then set in motion, the clay being pressed down over the bell, which movement molds the material into what is desired. The ware is then taken back into the shop to stand till dried. In summer the natural air of the room is sufficient for this, but in winter the building has to be heated by steam. When thoroughly dried the ware is placed in kilns or ovens and burned to a hard stone body. This demands a full fire of 36 hours. The time occupied from the filling of a kiln to the withdrawal of the ware is from four to five days. The vitrifying process is done when the ware is at its highest heat in the kiln. This is accomplished by salt being thrown into the fire a number of times until the ware is completely glazed. To always feel certain that this is done, it is the custom, after a kiln has been filled and before it is closed for firing, to put in a small piece of ware opposite the movable brick in the wall of the kiln. When it is judged that the glazing is complete the appearance of this piece, which can be easily taken out, is a sure index. When the ware is taken from the kiln it is ready for the market. Kilns are 20 to 22 feet in diameter and about 12 feet from the floor to top of cone. Their capacity runs from 18 to 20 tons of ware, according to its shape and dimensions. When a kiln is set with large pipes smaller ones are placed inside them.

The Calumet Fire-Clay Co. manufacture vitrified salt-glazed sewer-pipe for city drainage, chimney linings, and chimney pipe for cheap houses, summer kitchens, tenement houses, etc.; also chimney-tops for increasing height, improving drafts, and for ornamentation purposes, lawn vases, fire-bricks and tiles for furnace linings, and lately have entered into the manufacture of monuments and tablets for the dead.

The company have occupied their present location for thirteen years, and have enlarged their premises from time to time, until their buildings now furnish almost 100,000 square feet of space. Four steam-engines furnish power, and they have a very complete outfit of the most improved machinery and other appliances for turning out their wares speedily, cheaply and as near perfection as they can be produced. They have 22 kilns, and employ about 100 hands, and their yearly gross business reaches well toward half a million dollars. Every effort is made to cheapen production, and they are anticipating good results in this direction from the use of natural gas, for a supply of which they are now contracting.

H. D. Sizer, Esq., of Cleveland, O., is President of the Company, and Dr. W. H. Garlick, who lives at the works, is Secretary.

ENGINEERING NEWS
AND
AMERICAN CONTRACT JOURNAL.
Tribune Building, New York City.

The Engineering News Publishing Company, Proprietor.

Published Every Saturday.

CONDUCTED BY
GEO. H. FROST and D. McN. STAUFFER.

TERMS OF SUBSCRIPTION:
$4.00.....PER YEAR TO U. S. AND CANADA.
$5.00..... " " FOREIGN COUNTRIES.
Make all drafts and cheques payable to ENGINEERING NEWS PUBLISHING CO. Postal Money Orders, for convenience, may be made payable to GEO. H. FROST.

THE attention of contractors is called to the advertisements for proposals on another page.

THE prize jury of the Hygiene Exhibition at Berlin (Germany) has awarded a gold medal to the Neuchatel Asphalte Company for exhibits of their manufactures.

THE Manchester Ship Canal bill has passed its third reading in the House of Commons, and may be considered as legalized. The effect of this canal on the trade of the great sister cities—Liverpool and Manchester—will certainly be great, and the former city shows alarm and jealousy.

SURVEYORS, machinists and engineers generally, who use steel tapes, will be pleased to hear that Messrs. Keuffel & Esser have brought out an automatic cleaning and oiling attachment for steel tapes.

Experiments have failed to discover a material for steel tapes that would not corrode.

In the improved tapes all moisture and dirt are excluded from the box, while the tape is thoroughly oiled by the operation of unrolling.

This improvement was introduced and patented by Mr. John Avery, Assistant Engineer Bureau of Sewers, New York.

WE are in receipt of a bound copy of the seventh volume of the *Sanitary Engineer*, containing 26 weekly issues of that journal, from December 7, 1882, to May 31, 1883.

Among the articles of permanent value may be mentioned "Letters to a Young Architect on Heating and Ventilation;" "Steam Fitting and Steam Heating;" "The Edison System of Wiring Buildings for the Electric Light;" illustrated descriptions of the sanitary arrangements in the residences of "Cornelius Vanderbilt, Esq., the Berkshire Apartment House, Home for Aged Females, and the Duncan Office Building;" "Steam Heating Companies in New York;" "The New York Water Supply," and much else that cannot fail to interest the Sanitary Engineer. Bound in cloth, with Index, $3. Postage, 40 cents.

A VERY startling piece of information comes to us from Rivè-de-Gièr (France). A block of ore, weighing some 35 pounds, was broken into small pieces and placed in a melting-furnace. When the ore reached the red-hot temperature, a reagent was added and the fusion of the ore was complete in three minutes. This fusion was iron, and the reagent cost only 18 cents per ton of the metal obtained. A blast-furnace would thus produce 22 tons of iron every 14 minutes, instead of every 12 days! Besides this, the furnace would clean itself at every operation. The experiments were made at the iron works of M. Brunon, and should these statements be proved, metallurgical interests would have to conform to another transformation not less important than that involved in the Bessemer process.

IT may safely be assumed that until the cholera epidemic, or scare, is over in Egypt, there will be no pressing necessity for a second Suez Canal. In fact, very few vessels may be expected now to choose that route, and the old Cape of Good Hope will once more come into prominence and seem to justify its name.

In the meantime, work on the Corinth Canal is being rapidly advanced. It is stated that the canal will be finished in four years, and that the cost will not exceed five million dollars. It will be only four miles in length, but then it will shorten the voyage from Adriatic ports to Greece, Turkey and Asia Minor by 185 miles, and the Mediterranean and Gibraltar route by 95 miles. Shafts and galleries have already been made, and a small railroad has been built.

WE are in receipt of the "Proceedings of the Association of County Surveyors and Civil Engineers of the State of Indiana, at its Third Annual Meeting, held in Indianapolis, January 16th and 17th, 1883." It is a neat pamphlet of twenty-eight pages, and besides the list of members and officers, constitution, by-laws, and proceedings of above meeting, it contains much practical information of use to surveyors. Jas. C. Pulse, of Greensburg, read a paper on "Laws Pertaining to County Surveyors and their Duties." W. A. Osmer, of Logansport, read a paper on "Drainage," and R. I. Morrison, C. E., of Knightstown, contributes a paper on "Random Lines," omitted from last year's report. The following are officers for this year: President, H. B. Fatout, Indianapolis, Marion County; Vice-president, C. R. Spencer, Clarksburg, Decatur County; Recording Secretary, J. C. Pulse, Greensburg, Decatur County; Corresponding Secretary, L. S. Alter, Rensselaer, Jasper County; Treasurer, Rob't. I. Morrison, Knightstown, Henry County; Executive Committee, W. A. Osmer, R. R. Spencer, H. B. Fatout, R. H. Walls, R. P. Mayfield.

THE reports of somewhat strained political relations between England and France come simultaneously with complicated reports of international engineering enterprises. The Parliamentary committee has reported against the Channel tunnel, but the sapient gentlemen must have arrived at their conclusions by very different if not devious ways, for their reasons, we are told, "differed so much that they refrain from presenting any collective statement of their views to Parliament." Can anything be more absurd? We have often heard of "agreeing to differ," but the "differing to agree" is really a new note on the mental and philological instrument. Curiously enough the French Chambers approved on the same day a report on a Channel bridge, which if it could, would or should ever be built, would leave our New York wonder a considerable distance behind. Perhaps the English may not exactly believe that the bridge project is somewhat different. We are also informed that the two governments, or rather the English government and M. De Lesseps, have come to an agreement as to the building of the new Suez Canal. It is to be completed by the end of 1888, and England lends the Canal Company $40,000,000 at 3½ per cent. for fifty years.

While such has been the action of the English government with regard to De Lesseps—and it may be diplomatic or not in every sense of the word—the merchants and ship-owners of England are loudly protesting against the proceeding, and demanding a second and an English built canal.

THE EAST RIVER BRIDGE.

At the first regular meeting of the Bridge Trustees since the reorganization of the Board, held on the afternoon of the 9th inst., the resignation of Col. W. A. Roebling as Chief Engineer of the bridge was presented and accepted. Colonel Roebling was appointed Consulting Engineer without pay, and C. C. Martin was appointed Chief Engineer, but without increase of salary.

Chief Engineer Martin submitted a plan for utilizing the fire departments of both cities in extinguishing any fires on the bridge, which plan was adopted.

The bid of $79,094 by the Keystone Bridge Company to furnish the steel and iron work for completing the warehouses under the New York arches was approved as the lowest, and Robinson & Wallace's bid of $186,000 for the masonry and carpenter's work for the same was also approved.

The contract for building the superstructure between Sands and High streets, opposite the Brooklyn entrance, was awarded to the Passaic Rolling Mill Company for $32,031.66.

The police force now employed on the bridge consists of 75 patrolmen, 3 roundsmen, 1 captain, and 16 conductors.

The electric lights on the bridge have not been working satisfactorily.

Four miles per hour is the maximum rate of speed prescribed for vehicles crossing the bridge. A pretty slow rate, and one that will be satisfactory to the ferry companies, no doubt.

The total of tolls from the bridge so far amounts to $30,568. The receipts for the bridge so far amount to $14,999,350.71; expenditures, $14,941,538.41; liabilities, $132,729.58, and assets, $275,822.80.

THE HEATED TERM IN NEW YORK.

The first week of this month was a hot one over nearly the whole continent. In this city the mercury maintained its position well among the nineties up to sundown on Saturday. In the country and in small towns and cities, this temperature, while being uncomfortable, is not considered unusually dangerous, and outside of New York we hear of no such lists of prostrations and deaths from heat as are served up in the metropolitan journals during each "spell of weather" such as visited us last week. New York on a decidedly hot day is like a furnace; the high buildings shut out the air from the streets, the pavements and sidewalks of which reflect a vast amount of accumulated sunshine; the air is stifling in places from the street smells; the tenement districts are overcrowded with a population the majority of which is utterly ignorant and regardless of sanitary precautions, and as a result hot weather here means a largely increased death rate.

For the last week in June the total deaths were 716, while last week they were 1,051, of which 672 were of children under five years of age. The cool weather of Sunday and succeeding days brought relief to hundreds of tenement rooms where death was the inevitable visitor under the conditions of the preceding days. There seems to be but little chance for relief for the little sufferers among the tenements. The city is doing its best to clean the streets and to enforce sanitary rules everywhere. The Board of Health is a very energetic and capable organization; extra medical service is employed by the city in the hot months; free ice is liberally distributed; free excursions to the country and on the water are given almost daily by benevolent individuals or associations; there are free baths by the city, and every means which benevolence can suggest to mitigate the sufferings of the poorer classes during July and August are employed. After all but a small portion of the people in need of pure air in this city can be given it by all these agencies, while they have only the vile tenements to spend the principal parts of their lives in.

The deaths of children are an index to the sanitary condition of a locality. In London the mortality of children under 10, in the metropolis generally, was 47.66 per 1,000, but among children living in improved dwellings, where there was a good circulation of air all round the dwellings the proportion was 24.04 per 1,000, or less than one-half. From a paper by Capt. Douglass Galton, read before the Society of Arts in London, in April, we quote concerning this subject:

> In the buildings of the Improved Industrial Dwellings Company, during a period of 16 years, the death-rate per 1,000 of persons over one year of age was only 10.35 in the company's dwellings, while it was 17 in the metropolis generally.
>
> The death-rate in these improved dwellings, of infants under one year of age, was even more favorable; for although the birth-rate was 5 in 1,000 more in the company's dwellings than in the metropolis generally, the death-rate of infants was only 1.7 higher in the improved dwellings than in the metropolis, thus showing that the conditions of occupancy in these dwellings are as favorable for infants as they are for persons of riper years.
>
> The other companies who have built improved dwellings can show equally favorable results. Inasmuch as infant mortality is a safe index of sanitary conditions, it is evident that the various improved dwellings afford a solution of the question as to how to obtain, in a densely crowded area in the middle of a large town, dwellings in which the poorer part of the inhabitants can live under proper sanitary conditions.
>
> *Necessity of Sanitary Dwellings for the Poorer Classes in Large Towns.*—The main efforts of the community in the matter of sanitation have been hitherto

directed to the water supply, the drainage and the removal of refuse matter from the midst of the population. These were the evils which were most prominent when the question of sanitation was first approached. Within recent years, however, the crowded and insanitary conditions of the dwellings of the poorer classes has forced itself upon public attention. Among the municipalities which have made serious efforts to diminish this evil may be mentioned that of Glasgow, whose efforts have been rewarded with marked success. The law enables insanitary houses to be condemned and pulled down, and the Artisans' and Laborers' Dwellings Act enables municipalities to buy the insanitary property, to pull it down and let or sell it for the building of improved dwellings on the site so cleared; and, in some cases, to build houses on the cleared sites. If we are to diminish the death-rates of our large towns, and to remove the numerous foci of preventible disease which they contain, it is in this direction that we must now push forward our efforts for improvements.

The more modern tenement house is an improvement on those of older date, and, no doubt, improvements in this class of dwellings are being constantly made. It would be a good thing, however, if a few hundreds of the older rookeries of the east side of this city could be abolished and their places occupied by structures better adapted for the home of human beings.

A SHORT LOOK AHEAD.

An abnormal inactivity was exhibited in the Pennsylvania iron trade during the second quarter of the year, growing out of apprehensions on the part of makers and users of iron and steel as to the declining tendency in prices, resulting from what seemed to be an inevitable over-production. One strong influence leading to that result was the incoming tariff reductions which have since taken effect. The consequent depression in trade brought prices to the lowest limits known for four or five years.

There is an improving tendency in nearly all branches, but at this time it is uncertain to what extent the improvement will go. The fact of the enormous producing capacity of mills and furnaces leads consumers especially to look for low prices, accumulated stocks and the consequent advantages to themselves. Whatever the future of the iron trade may be, the fact is, that demand is improving, inquiries multiplying, and there is a general disposition to purchase summer requirements, a disposition which was wanting all through the second quarter of the year. Two facts account for this, viz., the exhaustion of stocks, and the assurances that the new tariff law will not very materially affect the iron trade, iron production or iron prices. The improvement indicated is more in prospect than in reality.

At the present time railroad builders, ship and boat builders, railroad companies and all of the heavier consumers of iron and steel are preparing the lists of their probable requirements for the fall and winter, and from inside information obtained from some of these sources, it is evident that the demand for iron products will be, if not larger than for any former year, yet sufficiently heavy to engage the normal capacity of the entire manufacturing interests. At least, there will be no severe cutting of rates, no crowding to the wall. The iron trade is free from that element which, in former periods of healthful activity, has brought about an unnatural competition, viz., the efforts of financially weak holders to sell stocks at any price, in order to meet obligations. Business is conducted on a more legitimate basis. New elements of competition are certainly coming up, but they will be healthful ones. One of these is the coming of Southern iron. Some large shipments have been received at Atlantic ports, and the iron is good and cheap.

The bridge builders are, next to the Bessemer steel rail men, better supplied with orders than any other branch of the iron industry. A large amount of bridge work will be presented during the summer and fall.

The trunk lines contemplate numerous improvements. In fact, it is the policy of the older roads to complete their lines with all necessary first-class facilities as to roadway and equipments. The rough-and-ready method of doing things on American roads is giving place to the English method of thoroughness. This is evidenced in the new construction work going on in the New England and Middle States especially. There is no occasion for the undue haste which has attended railroad building in the past, but special care is taken all the way from the preparation of the ties up to the smallest detail in the furnishing of equipments. The straightening of roads, the duplicating of lines, and the artistic care displayed in the construction of stations and depots, indicate that good sense and taste are employed, and that harsh utility is no longer the one standard by which railroad men are guided.

The basis of the improving tendency and growing prosperity lies in the expanding agricultural area North and South; in the more abundant facilities for marketing products of farm and shop, and in the increasing ability of the masses to avail themselves of the services of others.

Makers of bridge iron, plate and tank, sheet and galvanized iron, and manufacturers of car wheels, agricultural implements and steel rails, are pretty nearly all as well supplied with business for the coming three months as they have any right to expect at a time when a new tariff law is going into effect, and when a certain proportion of the producing capacity has been laid off. The iron trade is strong, and can afford to restrict production to market requirements.

Fifteen years ago the trade was controlled by little operators, who were obliged to keep at work and sell for cash; hence competition was more active, and at that time there was an absence of organization, which *now* arrests and controls any undue competition. To-day we have immense corporations organized and working in harmony, knowing what the country demands, and having an honorable regard for their mutual interests. This tendency to concentration is one of the conserving factors in the industrial problem of the future. It is developed to a high state of completeness in the iron trade, and the same influences which have produced these results in this branch will produce similar results in others. Hence, the fear of over-production so much talked about, while theoretically possible, if we consider producing capacity, is practically impossible when we look at the organization of iron interests and the conservatism which exists within the trade. Practically speaking, the iron trade is controlled by a few men, as are the railroad interests. This control does not involve the suppression of healthy competition, but simply restricts it within legitimate limits. Hence it is that steel rails have declined to $38 per ton, and remain there. Exceptional transactions may be heard of $1 or more below that price, but the railmakers have placed themselves where reasonable profits at least can be secured for some time to come.

These satisfactory conditions are working out a greater confidence among financiers and investors as to the safety and profitableness of investing capital in industrial interests, and hence it is that capital is seeking the more profitable employment in the smaller industries which the diversification now going on in the different trades has opened up.

While there is a concentration of capital and control going on, there is, on the other hand, a de-centralization of capital keeping pace therewith, which shows itself in a multitude of investments in the new sections now being opened, and which have been brought within reach of investment through the extension of our railway system during the past five years.

PERSONAL.

HENRY ESPERSON, formerly Surveyor Genera for Dakota, has been appointed Register at La Crosse, W'is.

NATHAN G. BEARDSLEE, Warsaw, N. Y., has been elected Chief Engineer of the Batavia, Albion & Lake Ontario R. R.

J. T. GERRY is re-elected Superintendent and Chief Engineer of the Burlington & North Western R. R. (N. G.)

PROF. H. E. SMITH has accepted a position as assistant to the Chair of Civil Engineering in Princeton College, N. J.

MR. HENRY C. MEYER, Editor and Proprietor of *The Sanitary Engineer*, sailed for Europe on the Gallia on June 27, for an absence of three months.

GENERAL HORACE PORTER, President of the New York, West Shore & Buffalo road, has donated $50,000 for a new observatory at West Point.

Mr. N. R. OLCOTT, Chief Engineer and Land Commissioner of the Texas & New Orleans road, has resigned his position to engage in other business.

ROBERT HARE POWELL, a leading operator in bituminous coal and a well-known iron manufacturer, died at Saxton, Bedford County, Pa., last Monday night, aged 57 years.

COL. JAMES ZABRINSKIE, a California pioneer, and author of the latest work on the land laws of the United States, died in San Francisco on Tuesday morning, at the age of 79 years.

MAJOR GENERAL SHALER, commander of the Seventh Regiment of New York during the war, and later chief of the N. Y. Fire Department, is the new president of the Board of Health of this city.

LEVI J. FULLER died at No. 365 West Eleventh street, New York, on Tuesday. He was born in Ludlow, Mass., in 1814, and was engaged with the late GEORGE LAW in the contracts for building the Croton Aqueduct.

The second annual exhibition of the National Mining and Industrial Exposition Association will be opened at Denver, Col., on the 17th inst. and will close on September 30. Ex-Senator H. A. W. TABOR is President, and W. A. H. LOVELAND is General Manager.

IRWIN MAHON, formerly a resident of Philadelphia, and at present engaged in the mining business at Pueblo, Col., has been appointed by Gov. PATTISON to act as Commissioner for Pennsylvania at the National Mining and Industrial Exhibition to be held in Denver.

JOHN D. VAN BUREN, Jr., has written a letter to GOV. CLEVELAND declining the appointment as Commissioner of the State Survey. He believes the work done by the State Survey should be under the direction of the State Engineer and Surveyor, and favors the abolishment of the board.

THE oldest road-master is Mr. J. M. JACKSON, at present in charge of the tracks, bridges and buildings on the Galveston, Houston & Henderson road. He is 73 years old, and has been connected with the Gould southwestern system for ten years and is credited with having laid a mile of track in the quickest time on record.

H. F. KENNEDY, General Superintendent of the Philadelphia, Wilmington & Baltimore, announces the following appointments, to take effect July 1: H. H. CARTER, superintendent of the Maryland division, with office at Wilmington, Del.; A. C. HIPPEY, assistant engineer of the Maryland division, with office at Wilmington, Del.

BURLINGTON & POTOMAC.—General Superintendent H. F. KENNEDY announces the following appointments for the Baltimore & Potomac, Alexandria & Fredericksburg, and Alexandria & Washington roads, to take effect July 1: H. H. CARTER, superintendent, office, Wilmington, Del. A. FELDPAUGH, engineer maintenance of way, office, Philidelphia, Pa.

H. N. ELMER, C. E., whose handsome individuality recent visitors at the St. Paul Convention will remember, was elected Building Inspector and Sanitary Engineer for the City of St. Paul, on the 5th inst., his duties to commence on the 28th. MR. ELMER is now busily engaged on the surveys for the sewerage of Duluth, for which R. HERING, Sanitary Engineer, is to devise the plans and be the Consulting Engineer.

NATIONAL BOARD OF HEALTH.—At the annual meeting of the National Board of Health, held in Washington June 22, the following officers were elected to serve during the ensuing year: President, DR. JAMES L. CABELL, of Virginia; Vice-President, DR. STEPHEN SMITH, of New York; Secretary, GEORGE E. WARING, JR., of Rhode Island;

Executive Committee, DR. T. S. VERDI, HON. T. SIMONS, and DR. CHARLES SMART.

CHICAGO, BURLINGTON & QUINCY.—The following changes are announced to take place July 1: JOHN S. CAMERON, at present assistant to the general manager, will be assistant to the third vice-president. W. J. MCCLURE, chief engineer of the lines east of the Missouri River, will be consulting engineer. GEORGE C. SMITH, late purchasing agent, will be chief engineer. H. B. STONE will be assistant general manager, and will continue to act as general superintendent. GEORGE W. HOLDRIDGE will be assistant general manager of the Burlington & Missouri River road in Nebraska.

A BOARD of officers of the Corps of Engineers, to consist of Colonel JOHN NEWTON, Lieutenant Colonel CYRUS B. COMSTOCK and Major GEORGE L. GILLESPIE has been constituted to meet in New York City for the examination of the following named officers, with a view to their promotion in the Corps of Engineers when legally entitled thereto: Captain MILTON B. ADAMS, First-Lieutenant HENRY S. TABOR and Second-Lieutenant OSCAR T. CROSBY. The Board will be assembled at as early a date as practicable on the call of the senior member thereof.

SANITARY AND MEDICAL SERVICE ON BOARD PASSENGER VESSELS.—The following committee was appointed to carry out the resolution adopted by the American Medical Association for securing more competent medical and sanitary service on board trans-oceanic passenger vessels (see resolution in The *Sanitarian*, 113 Fulton St., N. Y., June 21):

DR. A. N. BELL, New York,
DR. A. L. GIHON, U. S. Navy,
DR. I. N. QUIMBY, New Jersey,
DR. H. O. MARCEY, Massachusetts,
DR. HENRY H. SMITH, Pennsylvania.

MESSRS. W. N. FLYNT & CO., contractors, have in hand some very large contracts. At Taftville, Conn., they have 125 men at work in the new mill of the Pomona Co.; at Colchester, Conn., they are working 100 men on the Hayward Rubber Co.'s raceway; at Stamford they are under bonds to complete two large buildings for the Yale & Towne Mfg. Co.; they are also engaged on contracts at Watertown, Waterbury, Amherst, Palmer, Indian Orchard, Worcester and in a grading contract with the Connecticut River R. R. From 500 to 700 men, 20 horses, 10 cars, 12 hoisting and pumping engines and 30 to 40 derricks are some of the items used in propelling the machinery of this enterprising business concern.

CORRESPONDENCE.

LAYING SUBSOIL DRAINS.

KEENE, N. H., July 6, 1883.

EDITOR ENGINEERING NEWS:

In reply to your correspondent asking information concerning the best manner of laying subsoil drains in connection with sewers, I may perhaps be allowed to state a few facts which experience has taught during the construction of the sewerage in the city of Keene. The system of sewerage here adopted, and now nearly completed, is the Waring system, and of the ten miles already constructed eight or more have been laid with tile drains alongside of the sewer pipes. A large portion of the city thus sewered is situated on low ground only a few feet above the Ashuelot River, into which the sewage is discharged at three outlets, and a great amount of ground water has been encountered during our work here.

The average depth of the sewer pipes from the surface of the ground is about six feet, and in some places the water flowed into the trench in such quantity that two Edson diaphragm pumps, worked at a few feet in advance of the pipe laying, were only adequate to lower the water to an inch or so above the bottom of the pipe. The pipes were then laid, carefully cemented and dry dirt packed around the cemented points and the dry filling continued up to one-half the diameter of the pipe on which the tile pipe could be laid free of the water. The size of the tile pipes in such places will have to be determined by the judgment, but those of two inch interior diameter may be depended on to carry a great amount of water and to be large enough for all ordinary trenches. Frequent outlet of the tile into the sewers by running it into a Y or a manhole will enable the use of smaller sizes. The form of tile here used has been round, the diameters varying from 1¼ inches to 2½ inches, and two feet in length. It is non-porous, water being admitted at the joints, which are carefully wrapped about with muslin torn into strips three inches wide and long enough to go round the pipe twice. We have rarely found it practicable to drain a wet trench during the construction of the sewers by laying the tile in advance or underneath the sewer pipe. In the construction of brick sewers, however, this method is often advantageous, and by carefully filling with coarse gravel and stone around and over the pipe placed underneath the brick work a reliable foundation may be secured.

In a few cases, in laying the larger sizes of sewer-pipe, 12 inch and 15 inch, where close sheathing was required and running sand often left large cavities behind the planks, we have laid the tile directly over the sewer-pipe with three or four inches of packed earth between. In this manner there was no danger of disturbing the tile when the sheathing was drawn. Outlets to the tile were then given into the manhole at each end of the tile line.

As regards the efficiency of these tiles in draining the soil, it may be well to state what this city has already learned concerning their operation here. Since work was begun on the sewerage last September, several house connections have been made during the past few months, and the soil is now found nearly dry where, in laying the sewers last fall, it was difficult to free the trench from the great amount of water. The rapidity also with which the surface of the streets becomes dry also attests the efficiency of these tiles in securing a thorough and satisfactory drainage to even the wettest portions of the city. Respectfully, L. M. MUZZEY, Engineer in Charge.

STATISTICS OF LARGE CHIMNEY SHAFTS.

501 CALEDONIAN ROAD, HOLLOWAY,
LONDON, N., ENGLAND.

EDITOR ENGINEERING NEWS:

Will you kindly allow me to ask through your journal if some of your correspondents will give height, thickness of masonry or brickwork at top and bottom, diameter or size, weight or quantity of materials used in constructing, depth of foundations, and cost of some of the largest chimney shafts erected in America? Also, if all or any of the wrought iron ones built up of riveted plates have given satisfaction to their owners? I am, gentlemen, yours faithfully, R. M. BANCROFT.

FAST TIME IN LEVELING.

BEDFORD, Pa., July 8, 1883.

EDITOR ENGINEERING NEWS:

I do not like to use your valuable space for nothing, but I think our friend from "Down East" looks for a reply. I beg to say that no mistake has been made in either the statement or printing of the record published in a former issue under the head of "Fast Time in Leveling." The record was sent you with a view of "calling out," if possible, recorded time and conditions of good runs by other parties. Some of us boys down here have had experience with the level at different times, and would like to know what is considered "fast time." In this country "Profile" looks like a cut of a "Disston" cross-cut saw, and the levelers' ordinary work is from two and a half to three miles per day, giving grade ahead of the transit party. Very respectfully, J. M. RUDIGER, JR.

STONE DRESSING MACHINE.

WELLAND, Ont., July 8, 1883.

EDITOR ENGINEERING NEWS:

Will you or some of your readers inform me where I can get any information as to whether there are any machines made for dressing stone after it has been quarried? Dressing it fit to lay in first-class masonry? CONSTANT READER.

BEST WAY TO "PILE" LUMBER.

DEPARTMENT OF THE INTERIOR,
General Land Office,
WAUSAU, Wis., July 10, 1883.

EDITOR ENGINEERING NEWS:

DEAR SIR: In reply to the inquiries of A. Stiff, I will say that careful comparisons made between wood and timber piled and stood on end, has led to the conclusion that the best way is to "pile" (raising one end so as to give a slope of 1 in. to the foot). The side of timber will not absorb moisture from rain as fast as the ends, and by giving a slight slant the rain is easily thrown off.

The theory of hewed timber lasting longer than sawed is this:

In hewed timber the cut of the ax leaves the surface smooth, and also that timber is generally hewed near to the grain, while sawed timber is apt to be cross-grained, and the saw leaves a rough, fuzzy surface which absorbs moisture and retains it. The saw also leaves open the grain of the wood, leaving a better chance for water to soak in than hewing, which cuts the grain and leaves it smooth. Yours respectfully,

W. T. GRIFFITH.

REPORT OF DUTY TEST OF THE HOLLY-GASKILL ENGINES, SARATOGA, N. Y.

[From the Saratogian, July 4.]

Davis Coleman, Esq., President of the Board of Water Commissioners of the Village of Saratoga Springs:

SIR: Having received from your Board, under date of May 25, 1883, instructions to make an examination of your new pumping machinery, which should be full and complete in every particular, I visited Saratoga on the 30th for the purpose of a preliminary inspection, and on the 1st of June I made a careful internal examination of the pumps and engines.

The interval from the 12th to the 18th was employed in making preparations for a test, and in a detailed study of the machinery in operation, and on the last-named day a continuous trial of the boilers, engines and pumps was commenced, and continued as follows:

A test for duty was first made in a run of 68 hours, from 5 p. m. on the 18th to 1 p. m. on the 21st. The fire pressure was then put on, and the machinery was run under this pressure until 6 p. m. The pressure was then reduced to the usual domestic pressure, and the speed to that required to supply the demand for water.

On the morning of the 22d at 8:30 the engines were stopped for the first time during the trial and one of them was disconnected and the domestic service was then continued for two hours by one engine running alone, with which run the trial was concluded. I now present a preliminary report giving the results of the trial and the conclusions at which I have arrived. A detailed report will be presented as soon as it can be prepared.

I find as follows:

CONTRACT PERFECTLY FULFILLED.

First. In the construction of the boilers, engines and pumps the requirements of the contract have been complied with in all respects except that two Bulkley condensers have been supplied in place of the four air pumps and the jet condenser which were specified. This change seems to have been a judicious one. The condensers maintain a good vacuum. The situation is favorable for condensers of this character, as the depth of the pit, in which is placed the hot well for the termination of their discharge pipes, is such that as soon as a partial vacuum is formed the condensers will draw their water from the suction main without the aid of a pump, while the pressure in the delivery main is available to form the vacuum in starting. By this change four air pumps have been dispensed with, improving the economy of running and diminishing the liability to derangement.

ADMIRABLE INVENTION.

Second. The design of the engines is in one respect a novel one. Each high pressure cylinder is placed on the top of a low pressure cylinder. The purpose and effect of this arrangement is to obtain a short and direct passage for the steam from the first to the second cylinder at each end.

UNPRECEDENTED ECONOMY.

With the exception of the beam engine designed by Mr. Leavitt, all previous plans of compound engines of this class had involved long passages between the high and low pressure cylinders, which are wasteful of steam. By the above happy expedient this objectionable feature is got rid of in these engines, and they are enabled to take rank among the most economical pumping engines. Special interest attached to this trial from the fact that these have been the first engines built after this design.

Third. In the details through which this general plan has been carried out there are no features

which seem open to criticism, but on the contrary all seem entitled to commendation. The construction is thoroughly mechanical in every respect. The forces are transmitted and the strains are resisted in the manner theoretically the most correct.

ENGINES STRONG AND DURABLE.

The parts are strong and well proportioned, and the workmanship is excellent. The result is seen in the performance of the highest duty without any sign of labor. I do not think that the study of any machine has ever given to me a stronger feeling of confidence in its durability. A weakness had appeared, however, in the sides of the pump chambers. In the original casting these sides were each stiffened by ten ribs 2¼ inches high, but they were found to yield under the water pressure. This was remedied by two bolts carried through each chamber, eight in all. With respect to these bolts, it is to be observed that they resist the strains better than anything else would do, that if introduced originally they would properly have been regarded as an excellent feature, and that it is doubtful whether in any other similar pumps anything so good could be substituted in place of them.

HONEST DELIVERY.

Fourth. As the pumps were working when I first saw them, and during my observations of them in domestic service, they delivered into the main for conduction to the village all the water that passed through them. There was no other open outlet for it. The relief valve, the by-pass valves, and the valves controlling the supply of water from the delivery main to the condensers were closed. When either of these was open, even in the least degree, the rush of water through it was attended with a good deal of noise, and as the machinery moves in silence, except the sound made by the four steam valves in striking their seats, any such noise would be distinctly heard.

PERFECT VALVE ACTION.

I found that every one of the 672 valves in the pump chambers to be in its place and in good order, with the exception of a few of the suction valves in two of the chambers, which were beyond my reach. The indicator diagrams taken from the four pump chambers show, however, conclusively, by the instantaneous and complete rise and fall of the pressure at the termination of each stroke, that all the valves are in place and are perfect in their action.

No water returned through the old pumps. It could be lost in this way only by leakage past both delivery and corresponding suction valves; if either one were tight that would prevent it. These were examined and put in good order after my first visit, and afterward on being run in my presence, the old pumps showed the same efficiency with the new ones, as nearly as they could be compared. Their perfect action was shown also by the absence of fluctuations of pressure in the delivery main. In compliance with the wishes of your Board, however, the valves which control the communication from these pumps to the delivery main were closed during the trial. It is as I learn, the practice to keep these valves open, that all may be in readiness for starting the old pumps at any moment, and when so set open no loss of water takes place through them.

Fifth. As the water is delivered by the pumps direct into the distributing mains, its volume cannot be measured. The capacity of the pumps is found therefore by computation from the displacement of the plungers. The loss by return of water through the valves while closing, technically termed the slip, is very small, only a fraction of 1 per cent. and cannot be seen on the diagrams. I have, however, deducted 1 per cent. for slip. The expansion of the water at its temperature, 71 degrees, is only one-fourth of 1 per cent., and is disregarded.

CONTRACT FOR DELIVERY EXCEEDED TWENTY-THREE PER CENT.

There are two double-acting plungers, each 20 inches in diameter by 36 inches stroke, having rods 4 inches in diameter. The average area is 307.88 square inches, and the aggregate travel is 12 feet at each revolution. Deducting 1 per cent. we have on each revolution 43,890 cubic inches, or just 190 gallons of water delivered. By computation made on this basis the pumps, at 18 revolutions per minute, deliver in 24 hours 4,924,800 gallons or upward of 23 per cent. in excess of their required capacity.

Sixth. On the fire-pressure test, the machinery satisfactorily demonstrated its ability to run under a water-pressure of 140 lbs. on the square inch at 18 revolutions per minute, "with safety to all its parts." There was an entire absence of vibration or other indications of labor.

If the means had existed for getting rid of the water, I should have increased the speed to 30 revolutions per minute, as guaranteed in the contract. There can, however, be no question of the ability of the machinery to run at that speed against 140 lbs. water pressure, since all its parts then show a large factor of safety.

PUMPS ABLE TO DO DOUBLE THE DUTY REQUIRED.

At that speed it will deliver 95 gallons of water per second, which is more than twice its required capacity.

Seventh. The test for duty was made a long one, to insure that the duty shown should be no more than the machinery was capable of performing continuously. No allowance was made for friction anywhere. The duty is the net useful effect in water delivered. An excellent test gauge was prepared expressly for this trial by the Ashcroft Steam Gauge Co., who also supplied the indicators used, 8 in number. The pressures in the suction and delivery mains were reduced to the level of the center of the plungers.

Only two elements enter into this computation of duty, namely, the water delivered against the pressure and the coal burned. The investigation of the performances of the boilers, engines and pumps which enabled the duty to be performed will be made in my final report, but these have nothing to do with the computation of the duty.

About five o'clock on Thursday morning, 60 hours after the commencement of the run, a part of the packing blew out from the man-hole plate on one of the boilers. It was found impossible to stop this leak entirely, and I have therefore made the computation for 60 hours instead of 68 hours.

During this time the engines made 68,255 revolutions, being an average of 18.96 revolutions per minute, and the average water pressure was 87 lbs. on the square inch.

Allowing 1 per cent. for the slip, there were done on each revolution 3,657.72 foot-pounds of work for each 1 lb. of resistance on the square inch overcome in the main.

Multiplying this number by the revolutions and the pressure as above, we have 21,720,100,000 foot-pounds of work done in the 60 hours in delivering water.

PUMPS EXCEED GUARANTEED ECONOMY TWENTY-EIGHT PER CENT.

The coal was hand picked and was of good quality, for it left only 4.73 per cent. of ashes and cinders. The whole quantity burned during this time, assuming the fires to have been in the same condition at the close as at the commencement, was 20,330 lbs., which shows a duty of 106,838,000 foot-pounds for each 100 lbs. of coal consumed. The above assumption, however, was not fully warranted, since by omitting the first 12 hours, the remaining 48 hours show, by a similar computation, a duty of 102,340,000 foot-pounds for each 100 lbs. of coal consumed, and this may be taken as the real duty of the machinery in regular service. It exceeds the stipulated duty by 22,340,000 foot-pounds or nearly 28 per cent.

The first 20 hours show an apparent duty of 117,580,000 foot-pounds, and the first 12 hours show an apparent duty or 127,170,000 foot-pounds. The system of observation was such that the apparent duty at different periods of the test can be accurately compared, and the real distinguished from the fictitious.

Eighth. The fly-wheel on the engine is insufficient to maintain its motion when moving slowly, and so permits fluctuations of the water-pressure, which increase in a rapid ratio as the motion of the engine is reduced. It is not possible to impart uniform motion to a column of water by means of two double-acting plungers, whose motions are controlled by cranks, as is the case here.

THE CRANKS ON THEIR DEAD POINTS.

The most favorable position for the two cranks is at right angles with each other, and so they are always set. The slowest motion of the water is when either crank is on one of its dead points. Midway between any two of these points, or when both cranks are at an angle of 45 degrees, the motion is accelerated theoretically 40 per cent. This is modified in these engines by the action of the connecting rods, and the acceleration is made different in each of the four quadrants, being 60 per cent. in one and only 25 per cent. in another. This is the case when the rotation of the cranks is uniform and is the best that can be done.

The fluctuations of pressure due to the above cause appear not to exceed 5 lbs. They could be reduced very much by employing a large air chamber, but I do not learn that this small amount of fluctuation is found very objectionable. The serious fluctuations are due entirely to the insufficiency of the fly-wheel which at slow speed permits large variations in the motion of the cranks. The fly-wheel meets the requirements of the contract, but that does not make it sufficient.

A fly-wheel 18 feet in diameter, having a rim 130 square inches in cross section area, would have just five times the regulating power of the present one; with such a wheel all fluctuations above 5 pounds would disappear even when running as slowly as 4½ revolutions per minute. The present shaft would not carry this wheel, but the bearings and their supports are ample. A new shaft will need only to be larger between the journals, and its form on each side of the wheel would properly be a truncated cone.

The old pumps deliver the water without any appreciable fluctuation. This is because they consist of four double acting pumps driven by cranks, which are so set that their dead points divide the circle of revolution into eight equal parts, and these cranks are kept in very nearly uniform motion.

Ninth. With the above described fly-wheel one pump and engine can, in case of necessity, be run alone entirely well. At present, with one engine, the fluctuations of pressure are excessive. There is a liability for a single engine to be caught on the centre. The fly-wheel should have holes at convenient distances apart around its face, so that a bar can be advantageously used to move it off.

SUPERABUNDANT FIRE PRESSURE.

Tenth. The engines maintain with ease a fire pressure of 140 lbs. on the square inch, and, as already stated, can deliver under this pressure 95 gallons of water per second. This pressure is the same that would be afforded by a reservoir in which the surface of the water was 320 feet above the level of the pumping station. Now, this would be a great head of water, but you have the very same thing with the capacity for delivering a volume far greater than can be carried away.

LOCAL EXPERTS CRUSHED.

Under these circumstances, to blame the pumping machinery, as I learn is being done, because only a small portion of this pressure can be realized in the hydrants in the village when streams are put on, is surely the very height of absurdity. The cause of this loss of pressure will have to be looked for where it exists.

THE ENGINE BLAMELESS.

It must be obvious to every one, on reflection, that the engines can have nothing to do with it.

Very respectfully,

CHARLES T. PORTER.

New York, June 28, 1833.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 322.)

DXLIV.—DEDHAM, MASS.

Dedham, Massachusetts, in lat. 42° 20′ N., long. 71° 3′ W., is on the Charles River.

Settled in 1635, it was incorporated a village in 1636.

Water-works were built by a private company in 1881, after plans of Percy M. Blake, C. E., taking the supply from a well in porous gravel. The well is 26 ft. in diameter and 18 ft. deep, lined with heavy stone-work, laid dry and faced on the inside from 3 ft. above the bottom to 1 ft. below the top, with 12 inches of brick in cement. This well is roofed over and ventilated, and the water is conducted from it by a 16-in. cast-iron pipe into a brick pump well 8 ft. in diameter and 18 ft. deep, from which it is pumped to a height of 168 ft. into a plate-iron stand-pipe 20 ft. in diameter and 103 ft. high.

There are 2 Knowles steam pumping engines, one a compound condensing engine capable of pumping 750,000 gallons 180 ft. high in 24 hours, the other a duplex high-pressure engine capable of pumping 1,400,000 gallons 230 ft. high.

Distribution is by 10 miles of cement-lined wrought-iron pipe of 10 to 4 in. diameter, with 80 fire hydrants, 75 gates, 275 taps and one meter. The town pays $50 per year for each hydrant; 20 more are to be added this year. Service pipes are of enameled iron.

The population in 1880 was 6.224. The daily consumption in 1882 was 80,189 gallons.

The capital stock of the company is $100,000, which is the cost of the works. There is no debt. The expenses in 1882 were $3,472.14 and the receipts $5,885.65. Winslow Warren is President and William F. Hill Clerk and Superintendent.

DXLV.—PORT JERVIS, N. Y.

Port Jervis, New York, in lat. 41° 20′ N., long. 74° 45′ W., is on the Delaware River, on irregular ground.

The village was laid out in 1826. Water-works were built in 1870 by a private company, after plans of John B. Jervis, C. E., and under superintendence of H. H. Farnum, C. E., taking the supply from springs and a small brook, to which have since been added other springs and a storage reservoir. The total water shed is about 380 miles.

The first reservoir is 125 feet above the village and is formed by an earth dam across a valley, flooding 17 acres and impounding 75,000,000 gallons. The second reservoir, three miles from and 400 feet above the first, floods 20 acres and holds 200,000,000 gallons. The water is discharged from it by a siphon over the dam, 1,300 feet long, and thence it flows in the channel of the brook. Distribution is by 10 miles of cast-iron pipe. The main from reservoir to village is of 12 in. and the distributing pipes of 8 to 3 in. diameter. There are 136 fire hydrants and 39 gates. The number of taps is not given, nor the daily consumption. The town pays $2,000 per year for hydrants. Service pipes are of galvanized iron and lead. The population in 1880 was 8,678.

The capital stock of the company is $45,000.

The bonded debt is $20,000 at 5 per cent. interest. No further financial statements are given.

Peter E. Farnum is President and L. Y. Ketchum, Superintendent.

DXLVI.—EL PASO, ILL.

El Paso, Illinois, in lat. 40° 45' N., long. 89° W., is on a prairie. Settled in 1850, it was incorporated a city in 1866.

Water-works were built by the city in 1882, after plans of Dr. F. Cole. The supply is taken from a well 10 feet in diameter and 60 feet deep, in the bottom of which are three 3-inch holes bored 54 feet deeper, the water from which rises 20 feet in the well. The water is pumped from the well by a "New Eclipse" windmill, operating a pump of 8-in. bore and 12-in. stroke, which lifts the water 58 feet into a wooden tank 16 feet in diameter and 24 feet high on a timber trestle.

Distribution is by ¼ mile of 6-in. Wyckoff wooden pipe and some 1-in. iron branches, with 6 fire hydrants, 1 gate and 15 taps. Service pipes are of wrought iron and lead.

The population in 1880 was 1,390. The works cost $6,000, and the bonded debt is $4,000 at 5½ per cent.

Dr. Frederick Cole is the Superintendent.

MEANS OF EGRESS FROM PUBLIC BUILDINGS.

A report has been prepared by Mr. Turnbull, the Master of Works in Greenock, which contains the results of measurements of the churches and halls in the burgh.

The number of buildings examined was 79, and of these 36 are churches, 21 halls in connection with churches and 22 miscellaneous halls. The points noted were: 1. The capacity of the buildings. 2. The width of doors. 3. The direction in which they open. 4. The position of the gas-meters. 5. Any other points calling for remark. And from these data Mr. Turnbull has calculated: 1. The width of door-space available for exits in proportion to the number of persons in the building; and 2. the time in which the building could be emptied, allowing about 18 in. by 18 in. for each person and supposing the stream of people to move out at the rate of one mile per hour. Out of 79 churches and halls it was found that in 53 cases, or 68 per cent., the outer doors open inward; in 14 cases, or 18 per cent., they open both ways, and in 11 cases, or 14 per cent., the doors open outward. There are great variations in the proportion of width of door space to the capacity of the halls, running from 1 ft. to every 25 persons to 1 ft. to every 152 persons. In a hall in East William street 1 ft. to every 25 persons is allowed, the doors open both ways and the hall could be emptied in about one minute; and in St. Andrew's Free Church the proportion is about 1 ft. to 29 persons, all the doors open outward and the church could be emptied in about one and a half minutes. The following abstract shows the ratio of door space to capacity of the best known and most frequented public halls in Greenock:

	Capacity about	Proportion of door space to capacity.	Probable time required to empty hall.
Town Hall	2,500	1 ft. to 78 persons	3¼ min.
Temperance Hall	900	1 ft. to 121 "	4½ "
St. George's Hall	700	1 ft. to 67 "	3 "
Theatre Royal	1,800	1 ft. to 120 "	4½ "
Queen's Rooms	500	1 ft. to 83 "	3½ "
New Assembly Rooms	500	1 ft. to 130 "	5 "

It has been stated that the large Mormon Hall in Salt Lake City has exit doors to the extent of 1 ft. to 25 persons; and while it might be too much to expect this as a general rule, yet 1 ft. to every 50 persons would be a fair and reasonable proportion. If this proportion were adopted it would allow any hall, however large, to be emptied in about two minutes, provided all the doors, passages and stairs were suitably arranged.—*The Architect.*

AN INTERESTING SUIT.

"His Imperial Majesty, the Sultan El Ghazi Abdul Hamid Kahn Sani, Sovereign of the Ottoman Empire, against the Providence Tool Company and others," is the name of a suit being tried at Newport, R. I. In 1873 the Turkish Government entered into contracts with the Providence Tool Company, the former agreeing to purchase and the latter to manufacture 600,000 Martini-Henry rifles and a large quantity of sabres, the entire cost of which was about $9,000,000. It was necessary for the tool company to have special machinery made in order to begin work on their contracts, therefore it was stipulated in the documents that Turkey was to provide a banker's credit in London, and maintain the same at all times three months in advance of the manufacture and delivery of the guns. This banker's credit was to assure the tool company prompt payment upon the execution of the work.

In order to be able to turn out the first gun under the contract, the tool company had to expend $3,000,000. All of the guns were completed at last, and the actual contract price was paid. But for certain reasons the tool company retained 50,000 of the rifles, and it was to recover these that the Turkish Government brought a suit in equity in the United States Supreme Court.

Mr. Justice Blatchford presided on the 10th. Mr. Wm. M. Evarts and Mr. Treadwell Cleveland, of the firm of Evarts, Southmayd & Choate, representing the Turkish Government, and Mr. William A. Butler and Mr. Thomas Stillman, of the firm of Butler, Stillman & Hubbard, of New York, and Mr. Benjamin F. Thurston, one of the foremost of Rhode Island lawyers, appearing for the Providence Tool Company.

Mr. Thurston made an able argument for the tool company, and paid a high tribute to the honorable dealings of Gen. Tewfik, the Turkish representative. He asserted that there was not a contract in the whole transaction that the Turkish Government had not violated; that especially was this true with reference to the establishing of a banker's credit; that the tool company suffered financially and to a vast amount in consequence, being compelled to raise funds in America at high rates, when in reality the Turkish Government ought to have furnished the funds three months in advance of the manufacture of each lot of guns under the contract. Mr. Thurston stated in the course of his argument that the justice of the defendant corporation's claim had been recognized by several representatives of the Turkish Government in this country.

After the argument Judge Blatchford took the papers.

GALVANIZED IRON.

The name given to galvanized iron would seem to imply that the zinc coating is put on by the electro-plating process which takes its name from Galvani, the discoverer. Such, however, is not the fact. Although there is some variation in the process used, the general method is to first clean the iron with acid, and then pass it through a bath of molten zinc. The coating thus obtained is impervious to water, and the iron does not corrode. On account of the increased durability of the iron, the cost of galvanizing is more than repaid. The process has been in use for a number of years, although many improvements have been made in the details. Most of the galvanizing in this country is done in New York, New Jersey and Pennsylvania. At first the largest sheet that could be galvanized was 6 feet by 2 feet. At present it is a common thing to galvanize a sheet 3 feet by 8 feet. It was formerly a large day's work to galvanize 3,000 pounds of metal. Some establishments can now galvanize 40,000 pounds a day. An annual royalty of $1,500,000 a year used to be paid on barbed fence wire, which is all made of galvanized iron. The expiration of patents has thrown open the business to wide competition.

The new tariff decreases the duty on galvanized iron a quarter of a cent a pound, and to that extent exposes American manufacturers to competition. Before the new tariff act passed it was predicted that it would either bring wages down or drive manufacturers out of the business. Thus far neither of these expected results has occurred. The price of galvanized iron has been adjusted to the new tariff, and American manufacturers still control the market in all branches except that of galvanized iron and steel wire. Some idea as to the amount of galvanized wire imported may be gathered from the fact that there is now pending in the United States District Court, before Judge Brown, a suit brought by Wolff, Kahn & Co., for $25,000 damages alleged to have been incurred on one shipment of galvanized iron wire imported by the Red Star line. Upon the trial there was a vast mass of expert testimony as to the different methods of galvanizing wire here and abroad. Among the witnesses were John A. Roebling, John C. Lefferts, Profs. Doremus and Chandler, and other experts, who described minutely the process of galvanizing. The steamship company sought to show that the damage to the wire was the result of unskillful manufacture. The owners of the wire asserted that the damage had been caused by bad stowage and the proximity of corrosive materials. Judge Brown is expected to decide the case in September.

The galvanizing of wire makes it last about five times as long as when not galvanized. The first galvanized wire in this country was made by Col. Marshal Lefferts of this city when he was President of the New York and New England Telegraph Company. He had been since 1845 engaged in selling galvanized sheet iron. He noticed that the telegraph wires rusted quickly, and he hit upon the plan of galvanizing the wire. The cost is only three-quarters of a cent a pound more. All telegraph and telephone wires are now galvanized. The wires with which the cables of the Roebling bridge are made are galvanized. This protects them from corrosion.

In this country the growth of the business of making galvanized iron has been enormous. The corrugated iron used in buildings is all galvanized. Chains and a thousand iron articles which are used in the various industries are galvanized, and new applications of the process are discovered almost daily.

NEWS OF THE WEEK.

THE NEW LONDON (CONN.) BRIDGE.—A great deal of opposition has been made against bridging the Thames. It is alleged that it would prove a great obstruction to navigation, but counter evidence was given by the harbor-master and others. The commission will give its decision in a few days.

WORK ON THE KANSAS & NEBRASKA RAILROAD will be begun soon.

A LINE from Fort Scott (Kan.) to Butler will doubtless be built by the Chicago & Alton, as subscriptions are coming in well.

THE receipts of the Brooklyn bridge for the week ending July 5 were $3,449; receipts for six weeks ending July 5, $30,568.50, or an average of $727.82 per day; receipts from foot passengers, New York, $9,522.58; from Brooklyn, $7,666.98. Receipts for vehicles, New York, $6,647.90; Brooklyn, $6,731.12. Average receipts per day, from foot passengers, $409.27; for vehicles, $318.55.

NAIL FACTORIES TO STOP.—PITTSBURGH, Pa., July 11.—The regular meeting of the Western Nail Association was held in this city to-day. After a full discussion, during which trade was reported to be very fair, it was decided to suspend operations in all factories for a month, beginning next Monday, The object of this move is to prevent any depression in prices. The card rate at present is $3.25 per keg.

THE MISSISSIPPI RIVER IMPROVEMENT.—The conference called by the St. Louis Merchants' Exchange, met at that city on July 11. Some twenty cities sent delegates, and the Governor of Ohio and several Congressmen were also present. Addresses were read in favor of the improvement of the river, and a Chairman, Vice-Presidents and other officers were elected. In the afternoon the following report was adopted:

Resolved, That it is the sense of this meeting that a river convention be held in the Mississippi Valley, the place to be hereafter designated, not later than the 20th of November, 1883.

Resolved, That it is the duty of the commercial bodies of the cities and towns and of the farmers and laborers in each Congressional district in the Mississippi Valley to petition their respective Representatives in Congress to uphold and vote for adequate appropriations for the improvement of Western waterways.

Resolved, That in the selection hereafter of members of Congress from the Mississippi Valley it should be the especial care of all the people interested that no candidates be selected except those pronouncedly in favor of Mississippi River improvement.

Resolved, That a sub-committee be chosen by this meeting to fix a time and place for calling the Mississippi River Convention, and that this committee prepare in due form the call for said Convention.

Resolved, That the seasoning of time has but rendered more valuable and necessary to the public welfare the proceedings of the Mississippi River Improvement Convention, held in St. Louis, October 26, 27 and 28, 1881, and we commend its action to the public mind.

THE LACLEDE & FORT SCOTT RAILROAD has not been sold yet, an injunction having been obtained from the St. Louis courts. The contract for building the line has been given to F. M Greene, of Clinton. Work will soon be begun on the last end of the road.

A NEW STEAMSHIP PIER is to be built at the foot of West Twenty-sixth street, New York. Engineer Green is preparing the plans.

A TUNNEL under the lighthouse grounds is to be made by the Staten Island Rapid Transit Railroad Company.

THE STORM KING BRIDGE.—It is stated that the union between the Pennsylvania, Slatington & New England and the Highland Junction Storm King Bridge railroads is to result in giving the Philadelphia & Reading and the Baltimore & Ohio railroads an entrance to Boston over the New York & New England road. The Pennsylvania, Slatington & New England road is nearly completed from Slatington, Penn., to Pine Island, N. Y., whence it proposes to use the Erie Pine Island Branch to Newburg until the Storm King Bridge road is completed. It is said that President Gowen, of the Philadelphia & Reading, has agreed to build 11 miles of road from Slatington to Port Clinton, Penn., which will make the short cut to Reading and Harrisburg. The connection of the Storm King Bridge road is intended to be made with the Pennsylvania, Slatington & New England road at Goshen, N. Y., and with the New York & New England road at Mattewan, N. Y., making a road 21 miles in length. The big bridge across the Hudson, in sight of West Point, will be 150 feet above high water mark, with a span of about 700 feet, the width of the river being 2,280 feet. This is designed to bring the entire line of the New York & New England Railroad into a direct and quick route from Boston to Harrisburg, Penn., where it connects with all the roads south and southwest, besides making an all-rail coal route from the mines to this city. General Manager Charles H. Swan, of the Storm King Bridge Company, says that the plans of the bridge provide that it can be built within one year and that the weight of the superstructure will be about as follows: Steel, 2,306,600 pounds; iron 2,315,505 pounds; timber, 521,920 pounds; total, 5,144,025 pounds, or 2,296 tons 985 pounds. The

greatest load to pass over the bridge is 1¼ tons per foot. The bridge will carry 2½ tons per foot, with a safety factor of 8. It is figured that the new line, when completed, will effect a saving in distance between Boston and Chicago or Cincinnati and the West of over 100 miles.

LOWELL (MASS.) IS TO HAVE A BRIDGE that will cost 70,000.

THE HUNTINGTON SYNDICATE will build a road from Eagle Pass, on the Rio Grande, to the City of Mexico. The same syndicate is said to have purchased the existing railroads in Guatemala, one of the leading States of Central America, and proposes to construct other roads and extensions into the adjoining Central American Republics of Honduras and Nicaragua.

GERMAN COAL MINING.—The production of coal in Germany in 1881 is officially returned at 48,688,000 tons, as compared with 46,973,000 tons in 1880.

THE INTERNATIONAL ROAD TO MEXICO will, it is said, be completed by a new construction company. J. Gould, Jr., will be at the head of it, and R. E. Hayes as general manager. Work on grading, etc., road from Laredo to Victoria (Tamaulipas), 300 miles, will be begun at once.

THE QUINCY (MASS.) WATER-WORKS COMPANY will supply the town for ten years.

A ROAD FROM WINTERPORT to DOVER (ME.) is spoken of. The distance would be 50 miles. The gauge would be only 2 ft.

THE CONTRACT FOR GRADING THE WISCONSIN, IOWA & NEBRASKA road from Marshalltown to Des Moines has been given to Henry & Balch of Minneapolis. The distance is 65 miles, and the work must be ready Oct. 1.

THE CONTRACT FOR BRIDGING THE WISCONSIN, IOWA & NEBRASKA has been given to G. W. Schullbacker of Indiana. This includes drains, engine-houses, etc.

SURVEYS ARE BEING MADE for an extension of the Wisconsin, Iowa & Nebraska to Kansas City.

THE CHICAGO, ROCK ISLAND & KANSAS ROAD project is being developed; surveyors are in the field locating the route. The road will be from Chicago to Kansas City; it will cross the Mississippi at New Boston, and pass by Chillicothe, Mo.

THE OPENING OF THE YELLOWSTONE PARK.—It is thought that the opening of the Yellowstone Park and the driving the last spike in the Northern Pacific Railroad will occur on the same day. It is said that the Secretary of War has authorized the military commander of the Missouri division to detail an engineer to proceed to the Park and superintend the construction of roads and bridges. The act appropriated $40,000, of which $2,000 was to be paid to a superintendent, and $900 to each of ten assistants, leaving $29,000 for roads and bridges.

SURVEYORS on the Jackson (Mo.) branch road reached Jackson on the 6th inst., and started toward Grand Tower.

ST. LOUIS is discussing about a New City Hall.

A FLORIDA IMPROVEMENT COMPANY.—PHILADELPHIA, July 11.—The Atlantic and Gulf Coast Canal and Okechobee and Land Drainage Company has received from the State of Florida an award of 535,385 acres of land in the southern portion of the peninsula for reclamation. This company has reclaimed nearly 1,500,000 acres of land in Florida.

IT IS PROPOSED to extend the Toledo & Ann road to Owosso, (Mich.)

SURVEYING THE MEXICAN BORDER.—A dispatch from El Paso, Texas, dated July 11, says: "The United States Primary Boundary Survey starts from Deming on the 12th inst. The detachment ordered for the survey by General McKenzie consists of only fifteen cavalry, two scouts, some Apaches, two mule teams and a small detachment of infantry. The Mexican force intended to co-operate with the expedition comprises eighty cavalry and a large staff of officers of the engineer corps, General Reviultas being in command. The operations will be commenced upon the Mexican side, the starting point being in the neighborhood of Lake Luzman. The American survey, which is under the sole control of Lieutenant Simmons, of the Corps of Engineers, will be most thorough, and the interests of the United States will be carefully watched. Equal vigilance will no doubt be exercised upon the other side, and many doubtful points will have to be submitted to the regular survey party, for which there is as yet no appropriation. Mexican officers believe that there will be an Indian war this fall. Hence the escort they have provided for their own engineer corps. This preliminary survey is made at the sole expense of the War Department, and is in anticipation of the treaty survey, for which four years' time for completion is allowed by Congress.

THE PEOPLE'S RAILROAD COMPANY.—Considerable attention has been called to a meeting of capitalists recently held at Indianapolis, in which a scheme for building a railway "from ocean to ocean and from lake to gulf," was discussed. Two double track narrow gauge roads were to be built, from New York to San Francisco and from Chicago to New Orleans. Articles of association were adopted, which provide for over 11,000 miles of narrow gauge road, with a capital stock of $360,000,000. The scheme is in the nature of a benefit association. A national syndicate is provided, to be composed of two hundred and fifty stockholders the members of which are to be elected from organized boards of stockholders along the lines of the road. Up to this time there are eighty-three subscribers, representing $112,000. As soon as ten millions is subscribed California capitalists stand ready to subscribe the balance, or as much as shall be required to build the road. The Indianapolis stockholders number forty-five. It is the purpose of the organizers to build a line first from San Francisco to Indianapolis. The project has so far met with a great deal of skepticism.

WATER-WORKS ITEMS.—Whitehall, N. Y., is to have water-works. Newark, N. J., will test the Bell Waterphone. Sherman & McDonough will build the new West Troy reservoir. Price, $18,000.

THE CINCINNATI SUBURBAN BELT RAILROAD COMPANY has been incorporated. Capital stock, $500,000. The road will run from a point on the line of the Northern Railroad to a point on the Ohio in Cincinnati.

ANOTHER LINE TO LONG BRANCH will, it is rumored, be built by the Pennsylvania Railroad unless the difficulty is arranged with the New Jersey Central.

THE CINCINNATI Engineers are to prepare specifications for an iron bridge over the Duck Creek.

THE CAPE COD SHIP CANAL.—BOSTON, July 6.—At a meeting of the directors of the new Cape Cod Ship Canal Company, held to-day, it was voted to fix the capital at $5,000,000. The following officers were chosen: President, William Seward, Jr., of New York; Vice-President, Joseph P. Haile, of Boston; Treasurer, Samuel Fessenden, of Sandwich; Clerk, William Howland.

CONTRACT AWARDED.—The Lighthouse Board awarded the contract for construction on Hallett's Point and Beacon, New York harbor, to the Cooper Manufacturing Company.

THE SOUTHERN EXPOSITION AND THE ELECTRIC LIGHT.—The managers at Louisville have closed a contract with the Edison Company of New York for incandescent lights. Forty miles of wire will be required, and the plant will cost $100,000.

CONTRACTS HAVE BEEN LET for the line from Marshalltown to Des Moines (Iowa), a branch of the Wisconsin, Iowa & Nebraska Railroad. The grading is to be done by Minneapolis men, and the bridge work by an Indianapolis contractor. The work must be completed in ninety days.

UNDERGROUND ELECTRICITY IN PHILADELPHIA.—A meeting of the stockholders of the National Underground Electric Company was held in Camden on Monday, when the president stated that a conduit had been laid on Market street, Philadelphia, but that extra funds were required. It was proposed to extend the wire from Market and Broad to the Schuylkill, down Tenth street, from Market to Chestnut, on Third street from Market to Chestnut, and on Juniper street to Vine. The cost of the extension is only $6,000, and by each stockholder giving two cents per share the sum of $9,200 can be realized. A considerable sum of money was paid in.

THE NORTHERN PACIFIC.—Mr. Haupt, the general manager of this road, said recently: "We expect to get our road through by Sept. 1. We are now about 15 miles west of Helena, and the work is being pushed east from Missoula. The gap is only about 120 miles. We will open up as fine a country as lies under the sun. There is no desert on the line of our road. Our elevations average 3,000 feet less than those of the Union and Central Pacific, and this gives us an advantage of about 10° less in temperature. We use the Mullen Pass in crossing the mountains. Five hundred miles of our road will be protected by trees. We are planting them now. This is a comparatively new idea. We intend making them a substitute for, and improvement on, snow fences or sheds. This will effectually guard against blockades in winter, which have heretofore been a great objection to overland travel."

VINCENNES (IND.) & OHIO RIVER RAILROAD SURVEYS.—A corps of engineers are to be engaged for surveys for this line. Messrs. Dennis and Hershey, engineers, are out viewing the route. Surveys will be made at once between Vincennes and White River. It is thought the line will be run straight to Louisville.

SURVEYS for a line from Winchester to Elizabethtown (Ky.) will be begun this month by Engineer Lum. It is also proposed to survey for a line from Lancaster *via* Danville to Nashville.

THE SURVEY OF THE DETROIT, MACKINAC & MARQUETTE ROAD is in progress.

BALTIMORE & OHIO RAILROAD EXTENSION.—A dispatch from Wheeling (W. Va.), July 6, says: "It leaked out to-day that the above company has been quietly surveying a route from Greenfield to Washington County, Pennsylvania, on the Monongahela River, to Easton Siding, on the main stem of the Baltimore & Ohio, in Marshall County, this State. The road will pass through Washington and Greene counties, Pennsylvania, and Marshall County in this State, passing through a fertile and valuable section of country.

"It is intended by this means to make a straight road from the Monongahela River to the main stem of the Baltimore & Ohio, and thence over the bridge at Bellaire west. By this road the necessity for building the Hempfield extension from Washington, Pa., to Greenfield, Pa., will be obviated and a much shorter route obtained."

THE SUEZ CANAL.—An agreement has been arrived at between M. de Lesseps and the Government of Great Britain, which provides for a new Suez Canal, parallel to the one now in existence for a reduction of the canal dues and for the appointment of an English surveyor of traffic.

BRIDGING THE STRAITS OF DOVER.—M. Achard has introduced a bill in the French Chamber of Deputies authorizing the taking of soundings for piers for a railway bridge from Cape Grisnez, on the French coast, across the straits of Dover to Folkestone in England.

FOUR MICHIGAN AND OHIO ENGINEERING CORPS are surveying different routes from Britton to Toledo. Two engineers from Marshall are in charge.

A NARROW GAUGE ROAD will probably be built from Danville (Ill.) to Eugene, a distance of fifteen miles. The charter has been obtained.

FIGHTING THE CHANNEL SCHEME.—The joint committee of the House of Lords and House of Commons, which has had the English Channel tunnel scheme under consideration, has rejected it.

CUTTING ELECTRIC LIGHT WIRES—CHICAGO, July 10.—The city electrician has declared war against certain of the electric light companies in this city by cutting all the wires not placed under ground. The competition has become so sharp between the companies that it is claimed they do not use properly insulated wires, and that they string them at random on the house tops, where contact with them would result in instantaneous death. A number of wires have already been cut.

GROWTH OF THE COAL TRAFFIC—ALBANY, July 10.—The tonnage on the canals for the first week in July was 172,612 tons against 140,565 tons last year. The shipments of wheat have increased 217,900 bushels; of corn, 230,000 bushels, and of rye, 96,600 bushels.

FALLING THROUGH A BRIDGE.—JACKSON, Miss., July 10.—A train on the Natchez, Jackson & Columbus Railroad fell through a bridge fifty feet high, near Natchez, yesterday, killing the conductor, T. O. Jennings, and injuring seven passengers.

SILVER MINES IN ESSEX COUNTY.—It is reported that silver has been discovered in the Black Mountains, in Essex County, N. Y. Specimens of the rock are being analyzed.

ILLINOIS COAL MINERS.—Most of the Illinois coal miners have resumed work at three cents a bushel for mining.

A NEW TELEGRAPH COMPANY.—The New York Underground Telegraph Company filed its articles of incorporation on Tuesday in the County Clerk's office. The company intend to run wires "under, over and through the streets and avenues" of every town and city in the state of New York, provided the consent of the local authorities is first obtained. The company has a capital stock of $50,000.

THE engineer corps of the Ohio Valley Railroad has located the east side of Bellaire, O., and work has been begun on the bridge at that place.

THE MAIN SHORE LINE.—The funds for constructing this line are to be found by the following plan: The Maine Central Railroad, having leased the Shore Line from Bangor to Sullivan, agrees to pay six per cent. interest on the $750,000 which its construction will cost; one per cent. of this to go to create a sinking fund, which in the term of forty years will extinguish the sum above named, at which time, the principal and interest having been duly disharged, the Maine Central comes into absolute ownership of the road. To raise the necessary funds, a plan has been adopted similar to that by which several Western railroads have been built, where they have been leased by other corporations prior to their construction. The Maine Central will issue its own notes of bonds for $750,000 at 5 per cent. interest. These bonds are now being prepared in New York, and will be soon placed upon the market. The $750,000 of bonds issued by the Shore Line Railroad will be placed in the hands of some strong trust company as collateral security for the like amount issued by the Maine Central. The latter corporation will pay to the trust company the 1 per cent. which is to go to create the sinking fund for the extinguishment of the original bonds of the Shore Line. When this debt, principal and interest, has been dis-

charged according to the terms of the lease, as above stated, the Shore line comes into the absolute ownership and becomes an integral part of the Maine Central. The stock of the Shore Line will, of course, be only valuable as an evidence of the public spirit of the original subscribers thereto.

TWO DOCKS are being built at Agate Bay for the Duluth & Iron Range road. They will be built on sides of channels. The iron-ore dock will be 500 feet long; the merchandise dock 200 feet. The width of the channel will be 160 feet.

THE CURTIS REGULATOR.—The Merrimack Mfg. Co. has recently put in a five-inch Curtis Pressure Regulator to regulate the pressure on their steam pump, which throws a 10-in. stream of water and feeds seven thousand horse-power of boilers.

THE NICKEL PLATE ROAD continues to be a subject for speculation. It is now asserted that it is likely to become the property of the Gould combination, and that Vanderbilt does not want it, and has therefore neglected it. For a new road the main line of the Nickel Plate is in comparatively good condition, but a great number of side tracks would have to be built in order to accommodate a large business, such as would come to it over the Wabash, and many additions and improvements would have to be made to bring the road up to such a standard as would make it equal to other east and west roads.

COMPLAINTS HAVE BEEN MADE AGAINST THE BRUSH ELECTRIC LIGHT WORKS in Elizabeth street, New York, and it was suggested that the company should condense the exhaust and waste steam, and have a smoke consumer.

THE LA CROSSE, IOWA & SOUTHWESTERN RAILWAY is under good way. It begins at Green Bay, Wis.; crosses the Mississippi River at La Crosse, and following a direct line thence to Alligator Head on the Southwest Texas coast, 140 miles from San Antonio. The entire distance is about 3,500 miles.

THE DUBUQUE & NORTHWESTERN is the name of a projected railroad. The capitalists of Dubuque are taking the matter up vigorously.

DRAINAGE IN ILLINOIS is being carried on extensively. There is the Great Mason and Hazewell drainage district, and Mason County has five other drainage districts, and will build one hundred miles of ditch.

THE ROUTE OF THE CHICAGO, ST. PAUL & NORTHERN PACIFIC IN WISCONSIN is being examined by General Rosencrans, and Director Chadsey has decided upon the Wisconsin route, from Genoa, or the State line in the southeastern corner of Walworth County, in a northwesterly direction, through the counties of Walworth, Jefferson, the northeastern corner of Dane, through Columbia, Adams, Juneau, Jackson, Clark, Chippewa, Barron, Burnett, and Douglas, with a branch running from Genoa through the counties of Kenosha, Racine, and Waukesha to Milwaukee, and another from Needah, in Juneau County, to a point on the St. Croix River, near Clifton Mills. The main line from Genoa to Superior City will touch Geneva, Elkhorn, Whitewater, Jefferson, Lake Mills, Portage, Necedah, Neillsville, and Flambeau. The company organizes with a capital stock of $11,000,000, and retains the option of increasing the amount at any time. This railroad project is an outgrowth of the old air line scheme, and the old Wisconsin Central grade, of 44½ miles, from Genoa to Jefferson, will be utilized. The route from Genoa is not yet decided upon. The new company's line will be 412 miles in length, and in the northwestern part of the State it will probably run nearly parallel with the Omaha road.

A BIG BRIDGE.—One of the principal spans of a gigantic bridge, which is being constructed for the Oude and Rohilkund Railway Company, is now erected at the makers' yard at the Old Park Works, Wednesbury, England. The bridge will be the largest ever made in the Midlands, and will consist of seven main spans, and nine small girder spans—each of the former 356 feet long from the centers of the piers, 25 feet wide, and 35 feet deep; and each of the latter 114 feet between the centers of piers. It is designed to carry the railway, and a roadway as well, over the Ganges, and is made entirely of steel supplied by the Landore Siemens Steel Company (Limited), Swansea. The weight of each of the large spans is 752 tons, and that of each of the smaller ones 127 tons, and the total weight of the whole will be about 6,500 tons.

THE UNITED STATES MINERAL WOOL COMPANY, New York, has received, during May and June last, orders for 261,000 pounds of ordinary mineral wool to be used in passenger cars. Thirty thousand pounds were ordered by the Ontario Car Company, of London, Ontario; 10,000 pounds by J. G. Brill & Co., of Philadelphia; 24,000 pounds by the Chicago & Northwestern, 27,000 pounds by the Gilbert Car Manufacturing Company, of Troy, New York; while three separate orders, for 10,000, 40,000, and 120,000 pounds respectively were received from the Pennsylvania Railroad Company.

THE KING BRIDGE COMPANY, of Cleveland, has lately taken two important contracts. One is to build a wrought-iron, doubled-intersection, high-truss bridge across the Colorado River upon the piers of the old bridge. It is to be 910 ft. long, 18 ft. roadway, to cost $45,000 and to be completed Dec. 1 next. The other contract was made with the city of Houston for an iron bridge over Waller creek. The Colorado bridge will have five spans 150 ft. each and one of 100 ft.

WATER-WORKS ITEMS.—JOLIET, ILL., will advertise for construction of water-works. Eastern agents are trying to convince the citizens of Racine, Wis., that they need water-works. Brockville, Ont., has bought a pumping engine from the Holly Manufacturing Co.

THE HEATING OF CROTON WATER by the pipes of the New York Steam Heating Company, forms a subject of complaint in some cases. In one house in Warren street the water enters at a temperature of 133° F.

THE WROUGHT-IRON BRIDGE COMPANY, Canton, has just shipped the materials for a $38,000 highway bridge at La Grange, Texas.

THE PITTSBURGH, MCKEESPORT & YOUGHIOGHENY Railroad bridge across the Monongahela River at the City Farm, Pittsburgh, was completed on the 28th ult.

THE TUNNEL of the Schuylkill Valley Railroad at Phœnixville will be completed within six months.

THE PASSAIC ROLLING MILL COMPANY, of Paterson, N. J., has just fitted up rooms at a cost of about $4,000, on the mill premises, for the accommodation of a literary association of the 400 employés, the rooms to be kept open, lighted and warmed and cared for by a janitor, all at the expense of the company. If circumstances seem to warrant it, the company proposes to establish and carry on a technical school for the instruction of would-be mechanics.

A HEAVY CONTRACT LET.—Sheriff Wilcox and P. Driesbach, of Bradford, Pa., have been awarded the contract for building the new line of the Baltimore & Ohio, which will run from Washington, D. C., to Philadelphia, a distance of 60 miles. The contract price is $1,500,000.

COLUMBIA & SOUTHERN.—This proposed road is to run from Columbia, Dak., to Sioux Falls, Dak., and is to connect with the Hastings & Dakota division of the Chicago, Milwaukee & St. Paul at a point yet to be decided upon. A corps of engineers is at work surveying the route, and the work of construction is to commence as soon as the survey is completed. The object of building the road, it is stated, is to bring Columbia in direct communication with Minneapolis and St. Paul.

BRIDGE CONTRACT.—The contract for building the new iron bridge over Kettle Creek, at St. Thomas, Ont., on the Canada Southern road, has been let to the Detroit Bridge and Iron Company, the work to be finished by December 1. The bridge will be 1,366 feet long and 92 feet high at the highest point; it will replace the wooden bridge which has been in use since the road was built.

THE EAST TENNESSEE, VIRGINIA & GEORGIA Railroad Company has made a contract for 500 new cars, to be built by the Southern Car Works, at Knoxville. The Knoxville Car Wheel Company will furnish 2,000 axles and 4,000 wheels. The cars must be delivered in the next few weeks. A number of new engines has been ordered.

MEXICAN RAILROADS.—MEXICO, July 10.—The damages caused to the Central Railroad by rains have been repaired to Celaya, and the road to Lagos will be open in three days. The uncompleted bridge at Encarnacion is the only important one destroyed, and its reconstruction is going on rapidly.

THE SOUTH PASS JETTY.—A British steamship loaded with cotton and grain ran aground in the South Pass while getting to sea from New Orleans several weeks ago, and was forced to pay $80,000 for lighterage and towage before she got into deep water. Now the French steamship Nantes, also loaded with cotton and grain, has run aground in the South Pass, her draught being only 23½ feet, and "arrangements have been made," we are told, "to have her hauled off." If these arrangements shall cost $80,000, the owners of the Nantes will be as greatly disgusted as the owners of the British steamer were. The Cotton Exchange protested in vain against the collection of $80,000 in the former case, but the tug-boat and lighter pirates had the ship at their mercy, and would not take off a dollar. So long as the port of New-Orleans is made unpopular by these exactions, the grain of the Northwest will avoid the river route.

THE NEW SUSPENSION BRIDGE SCANDAL AT NIAGARA FALLS.—LOCKPORT, N. Y., July 8.—An excitement of no small dimensions was caused here by the statement made in a local paper yesterday concerning the new Suspension Bridge Company. It seems that a year ago last winter, by act of the Legislature, seven Commissioners were appointed from the well-known citizens of this section of the State to locate a new bridge over the Niagara River. Among them were the Hon James Low, now United States Consul at Clifton, Ont., and the Hon. S. S. Pomroy, present editor of the *Suspension Bridge Journal*. They located the bridge site, and then declared their intention of forming a bridge company. The stock, amounting to $200,000, was taken by W. H. Vanderbilt and eight others, representing the New York Central and Canada Southern roads, the new controlling interest paying $20,000 down on the stock to bind the bargain. They then went to New York, formed a new company, so the article states, and elected officers. The trouble arises right here, where, as is claimed, it is discovered that Messrs. Low and Pomroy received $10,000 from the new company as remuneration for alleged services, while the other five commissioners are, it is claimed, left entirely out in the cold, although their work was fully as valuable to the railroad interests as that of their two more fortunate brethren.—*New York Sun*.

A NEW UNIVERSITY.—MILWAUKEE, July 10.—Articles incorporating the University of Milwaukee, an institution organized for the pursuit of learning and the culture of art, science and literature, were filed in the office of the Register of Deeds late yesterday afternoon. Charles L. Colby, William P. McLaren and Nathan E. Wood are the incorporators. The object of those who are moving in the matter is to establish in Milwaukee a seat of learning superior to any in the West. It is designed to place the institution upon a foundation of not less than $1,000,000, and to build up in connection with it a system of academies in different parts of the State and the Northwest which shall be under the same control and act as feeders to the university. The capital stock is $1,000,000. C. L. Colby is the President of the Wisconsin Central Railroad and W. P. McLaren is a wealthy commission merchant.

THE ASHLAND (OHIO) & JEROMEVILLE SHORT LINE is to be extended to the coal fields of Holmes and Coshocton counties.

THE MONSON ROAD (ME.) is progressing to completion; the engineer is W. M. Brown.

THE CONTRACTORS for nine miles of the Philadelphia & Baltimore line are M'Cafferty, Malloy & Co.

THE NEW YORK CONNECTICUT & AIR LINE.—The Connecticut Railroad Commissioners met at Bridgeport lately to give their decision on the location of the above road. The engineers of the Hartford and Harlem lines had spoken adversely with regard to it in previous hearings. Some mendments were made and the location approved.

THE MICHIGAN POSTAL TELEGRAPH CO. is to have lines to Detroit and Chicago. This is an outgrowth of the New York and Postal Telegraph Co., and has just been incorporated with a capital of $50,000. Several branches will be operated. Don M. Dickinson is to go to New York to perfect the details.

A LARGE ISSUE OF PATENTS.—On June 5 the Yale & Towne Manufacturing Company, of Stamford, Conn., received 22 patents, 20 of these being on the application of Mr. Emery, and covering the scales, gauges and testing machines which the company are about to manufacture. This is perhaps one of the most important issues of patents in a single batch which has ever come out of the Patent Office. It is certainly so in the classes to which the patents relate. Patents were also issued simultaneously in England, France, Germany and all important European countries, as well as in the principal English Colonies, so that a world-wide market is secured for the company's products in these machines.

THE SOUTH PENNSYLVANIA RAILROAD.—PHILADELPHIA, July 11.—At a meeting of the promoters of the South Pennsylvania Railroad Company, held yesterday, a committee, consisting of Dr. Hostetter, Mr. Twombly, F. B. Gowen, W. K. Vanderbilt, and W. C. Whitney was appointed to take charge of the construction of the line and act as a Board of Management until such time as a formal organization is effected. It is understood that the work is to be vigorously prosecuted. All the stock has been subscribed, Mr. Wm. H. Vanderbilt heading the list with $5,000,000 and Dr. Hostetter following with $2,000,000. The lowest subscription is $50,000. Nearly all of the Philadelphia & Reading board of management have subscribed $100,000 each.

A SUIT TO RECOVER $300,000.—PITTSBURGH, July 11.—Charles W. Siemens, a celebrated English inventor, to-day entered suit against H. Sellers McKee of this city to recover $300,000. The suit grows out of the failure of the Siemens-Anderson Steel Company of New York, whose plants are located here. The company's property was sold out by sheriff's sale, and a portion purchased by Mr. McKee, and Siemens now aims to recover from him what he claims to be his portion of the proceeds of the sale, Siemens owned 300 shares of stock in the company, valuedat $1,000 each.